A paper prepared for the

Economic Council of Canada

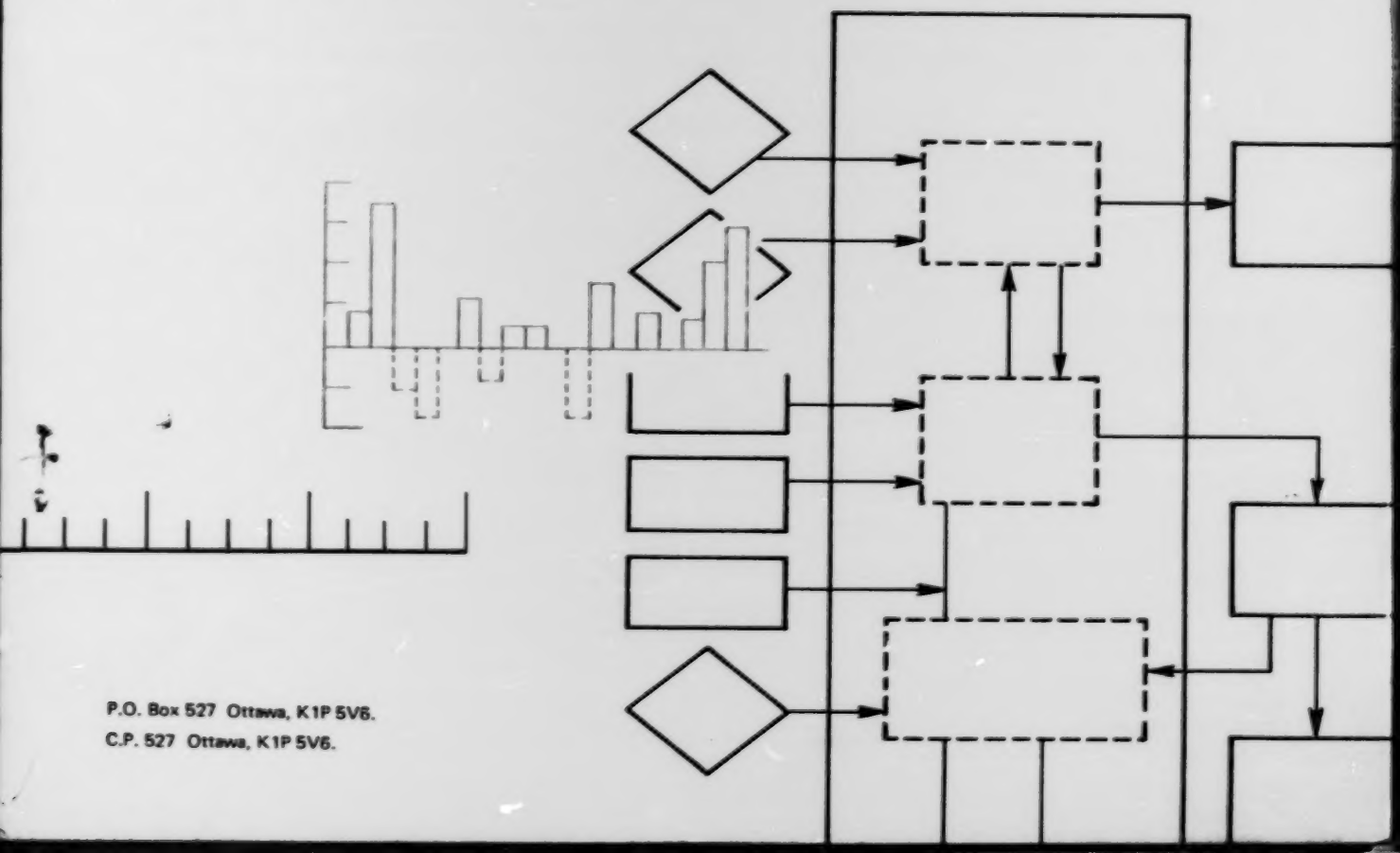
DISCUSSION PAPER NO. 229

Occupational Demand: Estimation and Projection

by Tom Siedule and
Norman Leckie

Un document préparé pour le

Conseil économique du Canada



P.O. Box 527 Ottawa, K1P 5V6.
C.P. 527 Ottawa, K1P 5V6.

The **Economic Council of Canada** was established in 1963 by Act of Parliament. The Council is a crown corporation consisting of a Chairman, two Directors and not more than twenty-five Members appointed by the Governor in Council.

The Council is an independent advisory body with broad terms of reference to study, advise and report on a very wide range of matters relating to Canada's economic development. The Council is empowered to conduct studies and inquiries on its own initiative, or if directed to do so by the Minister, and to report on these activities. The Council is required to publish annually a review of medium- and long-term economic prospects and problems. In addition it may publish such other studies and reports as it sees fit.

The Chairman is the Chief Executive Officer of the Council and has supervision over and direction of the work and staff of the Council. The expenses of the Council are paid out of money appropriated by Parliament for the purpose.

The Council as a corporate body bears final responsibility for the *Annual Review*, and for certain other reports which are clearly designated as *Council Reports*. The Council also publishes *Research Studies, Discussion Papers* and *Conference Proceedings* which are clearly attributed to individual authors rather than the Council as a whole. While the Council establishes general policy regarding such studies, it is the Chairman of the Council who bears final responsibility for the decision to publish authored research studies, discussion papers and conference proceedings under the imprint of the Council. The Chairman, in reaching a judgment on the competence and relevance of each author-attributed study or paper, is advised by the two Directors. In addition, for *authored Research Studies* the Chairman and the two Directors weigh the views of expert outside readers who report in confidence on the quality of the work. Publication of an author-attributed study or paper signifies that it is deemed a competent treatment worthy of public consideration, but does not imply endorsement of conclusions or recommendations by either the Chairman or Council members.

Établi en 1963 par une Loi du Parlement, le **Conseil économique du Canada** est une corporation de la Couronne composée d'un président, de deux directeurs et d'au plus vingt-cinq autres membres, qui sont nommés par le gouverneur en conseil.

Le Conseil est un organisme consultatif indépendant dont le mandat lui enjoint de faire des études, donner des avis et dresser des rapports concernant une grande variété de questions rattachées au développement économique du Canada. Le Conseil est autorisé à entreprendre des études et des enquêtes, de sa propre initiative ou à la demande du Ministre, et à faire rapport de ses activités. Chaque année, il doit préparer et faire publier un exposé sur les perspectives et les problèmes économiques à long et à moyen termes. Il peut aussi faire publier les études et les rapports dont la publication lui semble opportune.

Le président est le directeur général du Conseil; il en surveille les travaux et en dirige le personnel. Les montants requis pour acquitter les dépenses du Conseil sont prélevés sur les crédits que le Parlement vote à cette fin.

En tant que personne morale, le Conseil assume l'entière responsabilité des *Exposés annuels*, ainsi que de certains autres rapports qui sont clairement désignés comme étant des *Rapports du Conseil*. Figurent également au nombre des publications du Conseil, les *Études*, *Documents* et *Comptes rendus de colloques*, qui sont explicitement *attribués à des auteurs particuliers* plutôt qu'au Conseil lui-même. Celui-ci établit une politique générale touchant ces textes, mais c'est au président qu'il incombe de prendre la décision finale de faire publier, sous les auspices du Conseil économique du Canada, les ouvrages à nom d'auteur tels que les études, documents et rapports de colloques. Pour se prononcer sur la qualité, l'exactitude et l'objectivité d'une étude ou d'un document attribué à son auteur, le président est conseillé par les deux directeurs. De plus, dans le cas des *études à nom d'auteur*, le président et les deux directeurs sollicitent l'avis de lecteurs extérieurs spécialisés, qui font un rapport confidentiel sur la qualité de ces ouvrages. Le fait de publier une étude ou un document à nom d'auteur ne signifie pas que le président ou les membres du Conseil souscrivent aux conclusions ou recommandations contenues dans l'ouvrage, mais plutôt que l'analyse est jugée d'une qualité suffisante pour être portée à l'attention du public.

DISCUSSION PAPER NO. 229

Occupational Demand: Estimation and Projection

by Tom Siedule and
Norman Leckie

The findings of this Discussion Paper are the personal responsibility of the authors and, as such, have not been endorsed by Members of the Economic Council of Canada.

Discussion Papers are working documents made available by the Economic Council of Canada, in limited number and in the language of preparation, to interested individuals for the benefit of their professional comments.

Requests for permission to reproduce or excerpt this material should be addressed to:

Council Secretary
Economic Council of Canada
Post Office Box 527
Ottawa, Ontario
K1P 5V6

ISSN-0225-8013

May 1983

Table of Contents

		Page
Preface		i
Résumé		ii
Abstract		iii
Chapter I:	Introduction	1
Chapter II:	The State of the Art	9
Chapter III:	Methodology	17
Chapter IV:	Empirical Results	34
Chapter V:	Concluding Remarks	81
Appendix A:	List of Occupations and the Models Used to Project Them	87
Appendix B:	Summary of Data Sources and Industry Groupings	120
Appendix C:	Summary of Observed and Projected Vacancies for Selected Occupations	126
Appendix D:	Summary of Occupational Employment Projections	130
References		134

Preface

This study is an integral part of the program of labour market research at the Economic Council of Canada that culminated in the publication in June 1982 of In Short Supply: Skills and Jobs in the 1980's. Chapter 3 of that document summarizes the major findings of the research completed in 1981 on which the present work is based. The authors would like to acknowledge the useful comments of their colleques in the Labour Markets Research Group at the Council and the help of Keith Newton who commented on an earlier draft and made expositional suqqestions for the final version.

RÉSUMÉ

La présente étude tente de répondre à un besoin, chez ceux qui formulent les politiques et planifient les ressources humaines ainsi que chez les éducateurs, d'obtenir une vision plus exacte des perspectives du marché du travail pour les diverses professions. En présentant ce tableau, ce rapport offre aussi certaines idées nouvelles dans ce domaine.

Nous nous sommes d'abord efforcés de mesurer la demande globale par profession, soit la proportion qui est comblée (l'emploi) et celle qui ne l'est pas (les postes vacants). Les travaux antérieurs ont porté presque exclusivement sur le premier de ces deux aspects. Dans nos projections de l'emploi par profession, nous avons proposé de s'écarter de la méthode traditionnelle du "coefficient fixe". Pour notre analyse, nous utilisons un modèle stochastique unique à données transversales, qui intègre les effets, sur l'emploi, d'une forte utilisation de capitaux et de la part de la production.

Pour l'autre partie de la demande de travail, celle qui n'est pas "comblée", nous décrivons une nouvelle méthode d'estimation et de projection des postes vacants par profession. En outre, nous avons effectué une vérification pratique des récentes affirmations des employeurs dans les journaux à l'effet qu'il existerait des pénuries de main-d'oeuvre spécialisée.

Afin de favoriser les travaux empiriques dans ce domaine, nous concluons notre étude en réclamant la mise sur pied au Canada d'une solide base de données sur les professions et autres moyens de recherche sur le marché du travail.

Abstract

This study attempts to fill a perceived need among policy makers, human resource planners, and educationalists for an accurate view of future labour market conditions at the occupational level. In doing so, it proposes some new ideas in the area.

For one thing, efforts in this paper have been directed at measuring total occupational demand, comprising both its realized (employment) and unrealized (job vacancy) portions. Previous work has dealt almost exclusively with the former. In projecting occupational employment, we have proposed a departure from the traditional "fixed coefficient" approach. Our modus operandi makes use of a unique cross-sectional stochastic model which incorporates the influences of capital intensity and output share on employment.

Regarding the other aspect of labour demand -- its "unsatisfied" component -- we outline a novel method of estimating and projecting job vacancies at the occupational level. Another contribution in this area is an empirical verification of employers' claims of skill shortages recently heard in the press.

To aid further empirical efforts in this area, we conclude with a plea for the establishment of a solid occupational data base and labour market research/facility in this country.

Occupational Demand: Estimation and Projection

Chapter I Introduction

A causal explanation of past levels of demand by occupation and an accurate view of future developments are essential to government policy makers and educational planners for framing efficacious and just measures. Such knowledge is also of paramount importance to other concerned decision makers, including potential and present labour force members and entrepreneurs of private enterprises. Past experience, however, is testimony to our inadequacy in this area of occupational demand forecasting. From the early 60s to the present, even a casual observer must have noticed the existence of "flip-flops" in the labour markets for many professionals. For example, why did this country have an acute shortage of architects and engineers in the mid-60s, a surplus by the end of the same decade, and a shortage again in the late 70s? Cyclical swings in the economy may be identified, perhaps, as a cause of the repeated imbalances in this particular labour market, but the fact that similar mistakes have been made again and again in other areas as well should be sufficient indication of the impotence of labour market policy in Canada.

Are these dramatic turnarounds a necessary evil? Cyclical variations undoubtedly play an important role in determining the demand for some workers. However, if we take a closer look at the events, it is evident that the unavailability of reliable

forward-looking information has probably exacerbated this shortage-surplus crisis. It takes a minimum of four years of university education plus one year of practical experience for a high school graduate to become a licensed engineer or, for that matter, any practising professional. Such a lengthy lead time (five years) will pose problems for students, educators, and other decision makers, if they can only react to the current market situation rather than make their decisions on the basis of anticipated future conditions. Given the importance and relevance of occupational demand information, then, one would have thought a well developed manpower information system would have been in place by now. Unfortunately, this has not been the case. One of the objectives of this study, therefore, is to outline a way of filling this gap in our knowledge.

Numerous reasons can be offered for the relative scarcity of occupational demand information. These may be loosely classified into two groups, namely theoretical and modelling difficulties, and operational infeasibility. The following discussion will be devoted to an elaboration of these causes.

The world has recently witnessed a former, prominent actor becoming the president of the United States. We have also noticed a large number of high-powered computer system analysts whose basic training and formal education were actually in the natural and physical sciences, engineering or other disciplines. Clearly, then, a person's occupation is, to a certain extent, always in a

state of flux, being subject, of course, to supply and demand influences. In addition, many workers are multi-skilled. For instance, electrical engineers may be capable of handling the computer work of their firms as well as their own engineering tasks. Therefore, any attempt to model the demand for electrical engineers and computer programmers separately is tantamount to ignoring the flexibility that exists within occupations in the real world.

The emergence of a number of nationwide econometric models[1] in the 1970s has helped to broaden the Canadian policy-maker's capacity to foresee various aspects of the economy. However, it is curious that not one of them has the capability of projecting demand by occupation.

To be fair, the simple reason is that the theoretical difficulty in introducing the occupational dimension into a consistent nationwide econometric model is enormous. A simple inversion of the production function is inoperational, because the system ends up with more unknowns than equations.[2] When the translog factor demand model of production and technical change is used,[3] the system is algebraically solvable. However, for the system to be consistent, prices for the various factors of production, including rates for the different occupational labour inputs, should also be endogenized. Aside from the lack of usable occupational time series for serious econometric work, such an approach would create a scale problem for the econometric model

researcher. For it would add about one thousand behavioural equations to the existing macro model, and would inevitably make the total system cumbersome and imbalanced (that is, while a third of the equations would be related to the determination of the National Accounts components, a disproportionate two thirds would be devoted to the occupational variables). An equally important issue is that it is still not clear how the existing parts of any nationwide econometric system can be modified, in turn, to reflect the simultaneous changes in the occupational variables themselves.

The above discussion, however, may be academic. In practice, there exists virtually no time series on occupational demand suitable for serious econometric work. A quick examination of Canadian data sources should clarify this point. In Canada, there are three main sources of occupational demand information, namely the Job Vacancy Survey (JVS), the Occupational Employment Survey (OES), and the Census of Canada.[4] Unfortunately, each source has its own inherent shortcomings. The Job Vacancy Survey has been discontinued; for the period that it does cover (1st quarter, 1971 to 4th quarter, 1978), the unpublished disaggregated data are available to researchers upon request. The OES has also been shelved, though three surveys had been completed. The first one, conducted in 1973, was merely a developmental run and was never intended to produce reliable information for public use. The second survey was carried out in 1975 and the results

were published in December 1977, but because of questions raised over the next survey they are now considered unreliable.[5]

The final source of information on occupational demand, then, is the Census of Canada. The major problem there, of course, is that Census data are available only every ten years.[6] Furthermore, data from one census year to the next are not always completely compatible because of constantly changing occupational definitional bases.[7] That is, the Canadian Classification and Dictionary of Occupations (CCDO) manual was published in 1971,[8] and occupational employment data in the 1971 Census were collected and organized in accordance with the job descriptions found there. The corresponding 1961 Census information, however, is based on a completely different set of definitions, namely the 1961 Occupational Classification Manual of the Dominion Bureau of Statistics. Hence, any attempt to link the 1971 data to the 1961 figures would necessarily involve arbitrary measures.

From this brief survey of data sources, it becomes apparent that it is neither desirable nor feasible to have the occupational dimension as an integral part of a nationwide econometric model. Any attempt to explore this virgin area, then, has to be in the context of a satellite model.

Another equally important, but seldom asked, question is, "What exactly is labour demand ?" In most textbooks, the demand for

labour is depicted by a downward sloping curve which is conceptually derived from the value of the workers' marginal product. In empirical work, however, a schedule which relates the number of workers demanded to the wage rate is not useful, since it is difficult to find data that could represent labour demand. Employment figures alone would certainly not satisfy this concept, especially if the market wage rate is too low. In this case, firms would have difficulty employing as many workers as they would need and employment data would then underestimate the total demand for labour. This demand for labour, as defined in textbooks, must then be measured using another source of data. Job vacancy information may be a candidate but, as the following will demonstrate, there is difficulty with this concept as well.

Let labour demand = E + V, and

labour supply = L = E + U,

where E, V, L, and U are employment, job vacancy, labour force, and unemployment, respectively. Let EX represent excess demand for labour. By definition, then,

$$\begin{aligned} EX &= \text{labour demand} - \text{labour supply} \\ &= E + V - L \\ &= E + V - E - U \\ &= V - U \end{aligned}$$

It is clear that for excess labour demand to be equal to total vacancies as neoclassists maintain, unemployment must be equal to

zero. In the real world, though, where unemployment is rarely zero and normally positive, the concept of excess demand for labour cannot fully be captured by job vacancy statistics. Still, in this study, for operational convenience, we will treat only labour demand, which is equal to employment plus job vacancies, and ignore the textbook concept of excess demand for labour. Moreover, we will, at this time, ignore though not discount the importance of occupational supply, and its impact on the demand for labour, reserving that topic, perhaps, for other researchers.

The plan for the remainder of this study is as follows. Chapter II presents a brief survey of the literature. The methodology used for estimation and projection is the subject of the following chapter. Chapter IV contains the findings and interpretation of the empirical results. Remarks and observations conclude the study. Appendices are attached.

Notes

Chapter I

1 See Helliwell et. al., (1971), Institute for Policy Analysis (1978a, 1978b), McCracken (1973), and Conference Board in Canada (1977).

2 Let the production function of the architectural profession be ARCH SERVICE = f(ARCHITECTS, SPEC.WRITERS, DRAFTSMEN, CLERKS, CAPITAL). In this unconstrained production function, we have four labour input factors, and one capital factor of production. This equation by itself certainly does not provide enough information for determining the demand for various labour inputs, even if ARCH SERVICE and CAPITAL are defined elsewhere in the system.

3 See, for example, Berndt and Watkins (1981).

4 Two other sources of occupational employment data do exist, namely the Technical Service Council and the Pay Research Bureau. However, because these organizations collect data for a small set of specific occupations, their usefulness in an effort such as ours, i.e., to project employment for all occupations, is minimal.

5 To date, nothing official about this controversy has been released, outside of scattered newspaper reports. On the other hand, no official of Statistics Canada has openly challenged the accuracy of these stories.

6 At the time of printing, it has been learned that the occupational question will be asked on intradecade censuses (the first being in 1986), thereby providing the analyst with a more frequent reading of the labour market for detailed occupations.

7 To be fair, the 1981 Census (available in 1983) will compile labour market information on the basis of a system very similar to the 1971 CCDO.

8 See the Department of Manpower and Immigration (1971).

Chapter II The State of the Art

The Modelling of Occupational Employment

The fixed coefficient employment model was developed and used by the United States Bureau of Labour Statistics and the Organization for Economic Co-operation and Development.[1] Basically, such models multiply occupation-to-industry employment shares by the projected industrial employment levels, and then sum across industries. This approach has been frequently criticized for its failure to allow for the adjustment of inputs to changes in factor prices,[2] but until the work of Richard Freeman (1980), nothing constructive, in the way of feasible alternatives, had been suggested. Indeed, the fixed coefficient model remains the only tool capable of projecting employment for a large number of disaggregated occupations.

Freeman's own "augmented fixed coefficient" model, which incorporates a wage change variable to explain the change in occupational employment, does offer some potential for future methodological development. In its present form, however, his model may only be suitable for testing the feasibility of using the simple fixed coefficient model for forecasting purposes. By itself it is not a practical tool for projecting occupational employment. The reason is that Freeman's so-called "augmented requirement demand" equation has no forecasting capacity, unless someone else can supply the forecasted values for the

right-hand-side variables as well. In our opinion, the task of forecasting these variables is at least as formidable as forecasting the dependent variable itself in an ex ante exercise.

In Canada, the first major attempt to project manpower requirements by occupation on a nationwide scale was undertaken by B. Ahamad. His study, prepared in the later 1960s, reported estimates of manpower needs for just under 200 occupations for the year 1975.[3] This was the only occupational forecast on a nationwide basis available at that time, and when, in the early 1970s, a sufficiently disaggregated instrument, like CANDIDE, and new sources of information, like the 1971 Census and the 1971 CCDO manual, became available, researchers felt more comprehensive occupational information could be generated.

In response to this apparent void, a second formal attempt to forecast occupational employment in Canada was undertaken, this time by the former Department of Manpower and Immigration in the early 1970s. The model that they developed - COFOR - formed the basis of a new forecasting effort in that Department. It was capable of providing forecasts of employment for some 500 occupations. Being a fixed coefficient model, COFOR applied fixed occupation/industry employment ratios (using partly 1971 Census data and partly 1975 Occupational Employment Survey data) to projected industry employment figures (obtained from a macro model, CANDIDE) to yield the projected occupational employment figures. The advantages of using this model are obvious. For

one thing, it is capable of providing highly disaggregated occupational employment estimates. Furthermore, owing to the fact that the whole exercise involves only simple arithmetic operations, its computational cost is relatively low.

There are at least two reasons, however, why the COFOR approach should be modified.[4] First, COFOR disaggregates the 12 sets of industrial sector employment figures forecasted by CANDIDE (old version) to 69 sets of employment-by-industry figures. This is done through the use of either stochastic relative productivity equations (the ratio of the disaggregated productivity to the productivity of the corresponding industrial sector) or straight disaggregated productivity stochastic equations, in conjunction with the productivity, output and employment identity.[5] This process not only is time-consuming but makes it impossible for the sum of the 69 employment-by-industry figures to equal the total employment figures forecasted by CANDIDE without extensive post-forecast data massaging. The second reason for a revision of COFOR was the inability of that model to link directly to its macro model's (CANDIDE) ex ante projections, since the use of the productivity equations necessarily makes the linkage indirect. This meant that alternative occupational employment projections, based on different CANDIDE projected scenarios, were necessarily complicated and tedious exercises. In this study, we propose a modified version of COFOR - MODCOFOR - which is to some extent able to circumvent these difficulties.

In addition to the occupational employment forecasting models mentioned above, the federal Ministry of State, Science and Technology (MOSST) has developed the Highly Qualified Manpower (HQM) demand model to project the requirements for university graduates by level of educational attainment and by field of study.[6] Also, the Technical Service Council has developed an instrument capable of projecting the supply of, and demand for, bachelor graduates in engineering, chemistry, business and commerce, and accounting.[7] Since these models deal with selected groups of workers only, and a comprehensive review of them is already available in Foot (1980), they will not be described here.

The Vacancy Dimension

Occupational employment has often been erroneously called labour demand by occupation. As long as a model uses only observed employment data as inputs, it is dealing with only part of the story. The missing part is, of course, the job vacancy dimension and the present study will attempt to fill this gap. To this end we will propose an instrument to estimate vacancies. This complements our occupational employment model, affording us a legitimate method for analyzing and projecting <u>total</u> labour demand by occupation.

It is no exaggeration to say that the study of job vacancy by occupation is one of the most under-developed areas in economic

economic research today, both in theoretical and empirical work. As in the modelling of occupational employment, this lack of development may be attributed to the paucity of usable data. In Canada, job vacancy-by-occupation data were not available until 1971, when the Job Vacancy Survey (JVS) started collecting information on vacancies at a detailed occupational level. However, in the fourth quarter of 1978, the Survey was discontinued and there exists no comprehensive source of vacancy data covering the period since then.

Existing detailed occupational JVS data were never included in Statistics Canada publications, nor were they publicly available in CANSIM.[8] The job vacancy data used in our study were provided to us at the four-digit CCDO level on worksheets. Then, considerable computer work was carried out to transform them into machine-readable form. Finally, an accounting check was performed, and modifications made where necessary. Upon perusal of these data, vacancies at the detailed occupational level appear to be unnaturally volatile. While we have no scientific method of evaluating their accuracy, our experience with time series analysis leads us to believe that they are not without their shortcomings. Nevertheless, since they comprise the only comprehensive set of actual observations on vacancies, we have made use of them for our present purposes.

If the gap in information on occupational vacancies is wide, then the lack of any theoretical exposition on the subject

represents a veritable abyss. The economics profession has yet to develop a comprehensive theory of vacancies,[9] although not from lack of trying. The term job vacancy has occasionally been used in the discussion of wage dynamics. For instance, job vacancies may be employed as a proxy of excess demand for labour, and used to explain wage change.[10] This is, at its best, a derived theory of wage change, not a theory of vacancy. The roles of dependent and independent variables must not be confused.

There exists, also, a substantial amount of literature on the connection between the unemployment rate and job vacancy rate.[11] In its most elementary form, originating in Dow and Dicks-Mireaux (1958), the theory simply states that there exists an inverse relationship between the unemployment rate and the job vacancy rate. A rectangular hyperbola has been stylistically used to depict this. Hansen (1970) has provided the exposition of a theoretical model with the unemployment-vacancy relationship being negatively sloped and convex to the origin. Elsewhere, the unemployment-vacancy relationship occupies an important position in the debate of structural versus inadequate demand unemployment. It is useful in providing a means of distinguishing between changes in demand deficient unemployment and changes in non-demand-deficient unemployment: a movement along the unemployment-vacancy curve is said to signify a change in the former only, whereas a change in the latter entails an actual shift of the curve.[12]

In Canada, the United States, and Great Britain, the unemployment-vacancy curves have been found to shift outward.[13] The continuous shifting of the curve makes it difficult to recognize a unique rectangular hyperbola from the scatter diagram of historical unemployment and job vacancy data. The question is whether the unemployment-vacancy relationship has broken down completely or whether it has shifted so extensively that the downward sloping relationship is rendered unrecognizable. Reid and Meltz (1979), using quarterly data for the period of the second quarter of 1953 to the fourth quarter of 1975,[14] have found that the relationship does remain valid, although there exist some underlying, shifting forces throughout the sample period. That being the case, this unemployment-vacancy theory will be used as a means to facilitate our projection exercise described in detail in the following chapter.

Notes

Chapter II

1 See U.S. Department of Labour, Bureau of Labour Statistics (1968) and Tinbergen and Bos (1965).

2 See Freeman and Breneman (1974), Freeman (1980).

3 See Ahamad (1969).

4 Much of the following discussion is based on Employment and Immigration Canada (1979). The approach described there is now in the process of being re-evaluated by the Labour Market Outlook and Structural Analysis Directorate of CEIC.

5 The relative identity is $(P_i/P)\cdot(Q/Q_i) = E/E_i$, where P_i, P, Q_i, Q, E_i and E are the productivity of industry i, the total sector industrial productivity, the output of industry i, the total sector industrial output, the employment of industry i and the total sector industrial employment, respectively.

6 See Ministry of State, Science and Technology (1978a, 1978b, 1978c).

7 See Harvey and Murthy (1975, 1976, 1979).

8 The four-digit-CCDO vacancy data are on CANSIM tapes, accessible only to those who know the security codes of the series.

9 Holt and David (1966) provides a fairly detailed exposition on the concept of job vacancies, but falls short of constituting an acceptable theory explaining the variations in job vacancies.

10 See, for instance, Dicks-Mireau and Dow (1959) and Lipsey (1960 and 1974). As has been mentioned earlier, to equate job vacancy with excess demand for labour involves some operational difficulty.

11 See Cohen and Solow (1967 and 1970), Bunch and Fabricant (1968 and 1971), Gujarati (1969), Macrae and Schweitzer (1970), and Warren (1980).

12 See Newton (1977).

13 See Reid and Meltz (1979), Cohen and Solow (1967), Bunch and Fabricant (1968 and 1974).

14 The series is obtained by linking the Job Vacancy Survey data and the vacancy rate constructed by Denton, Feaver, and Robb (1975).

Chapter III Methodology

(A) Occupational Employment: Estimation and Projection

As has been indicated earlier, the fixed coefficient manpower requirements model has the advantage of permitting a highly disaggregative projection of occupational skills across industries, with very limited information. In the year in which the technical coefficients are calculated, the model is, in essence, a set of identities; that is, the calculated values will equal the actual number of people employed in their respective occupations. It becomes a model when the technical coefficients are applied to periods other than the one in which they were calculated.

Even with the existing data constraints, however, the fixed coefficient model is not the only instrument available for occupational employment projection. In our investigations, we have found that for some occupations it is possible to tackle the problem using a cross-section-stochastic-equation approach (described immediately below), which in some cases appears to yield more plausible occupational employment projections than the conventional fixed coefficient model. This method will not work, however, for occupations which are concentrated in a small number of industries. These industry-specific occupations then must be projected by our own fixed coefficient model, MODCOFOR.[1] Appendix A gives a complete listing of the occupations forecasted by the two methods, respectively.

Cross-Section-Stochastic Model (CSSM)

In this section, we propose the use of a distribution method to solve the problem of projecting occupational employment. Such a procedure allows us to take advantage of the industrial structural information embodied both in the observed data during the estimation stage and in the CANDIDE solution during the projection stage. However, one main drawback exists: the technique will fail statistically if the occupation is heavily concentrated in one or two industries, e.g., postmaster. This is because, in this case, the dependent variable will have only one or two non-zero observation points, which makes it impossible to estimate the coefficients of the specified equations.

a) Estimation

For occupations found in many industries, then, the specification for the jth occupation's employment share is as follows:

$$(E_{ij}/E) = b_0 + b_1 (Q_i/Q) + b_1 \, KINT_i + e_i, \qquad (1)$$

for i = 1, 2, 3, ..., 34,

where

E_{ij} = the number of people employed in the jth occupation of industry "i", 1971;

E = the total employment of Canada, 1971;

Q_i = the output (real domestic product) of industry "i", 1971;

Q = the total output (real domestic product) of Canada, 1971;

$KINT_i$ = a measure of the capital intensity (mid-year capital stock ÷ real domestic product) of industry "i", and

e_i = the error term associated with each observation (industry) "i".

Equation (1) pre-supposes that the share of the total employment in the jth occupation of a given industry can be explained predominantly by that industry's share of the total output and by the degree of capital intensity found in that industry.[2] In other words, the assumption is that as long as the output shares and the capital intensity remain the same, no change in the industrial distribution of occupational employment can be expected to occur as well. In reality, of course, the observed data points of the dependent variable are likely complicated by a number of other dynamic factors. This is a problem, however, that is merely recognized, though not yet solved.

The expected sign for the coefficient "b_1" of the (Qi/Q) variable is, naturally, positive: the greater the industry's share of the total output, the greater its employment share as well. As for the $KINT_i$ variable, the opposite is expected: the higher the extent of capital intensity within a certain industry,

then the lower its occupational employment; i.e., labour is substituted for capital. Therefore, the predicted sign of the corresponding coefficient "b_2", seemingly, is negative. For some occupations, however, which require skilled workers to operate capital equipment, higher capital intensity may actually lead to increased employment. This suggests, then, that for some occupations, "b_2" may be positive.

The specification of equation (1) is designed strictly for the use of cross-section data: the unit of analysis is the industry. The use of time series data was ruled out because the only reliable source of occupational employment data is, as we described earlier, the 1971 Census of Canada, which contains employment figures cross-tabulated by some 500 occupations and some 300 industries for the year 1971 only. Our approach aggregates those industries into 34 industrial groupings (covering the entire economy) corresponding to those in CANDIDE 2.0.[3] This use of CANDIDE's industrial classification facilitates the linking of the occupational/industrial employment (E_{ij}) to that model's ex ante solutions, in the next stage of our analysis.

Having obtained observations on E_{ij} from the 1971 Census, and observations on E, Q_i, Q, and $KINT_i$ for the year 1971 from other divisions of Statistics Canada, we were now able to estimate our specified equation (1). Of the 500 or so occupations included in the Census, we selected the ones that

appeared to be widely distributed across the industries. The resulting 211 occupations were each estimated with the typical specification of equation (1), using the software of the DAMSEL computer package.[4] The estimated coefficients - "b_0", "b_1", "b_2", a different set for each occupation "j" - are then passed on to the next stage.

b) Projection

The projection exercise can be performed by first re-arranging the estimated equation (1) so that E appears on the right-hand side. All variables now being in time series form, the final equation used is as follows:

$$\hat{E}_{ijt} = E_t(\hat{b}_0 + \hat{b}_1 (Q_i/Q)_t + \hat{b}_2 KINT_{it}), \qquad (2)$$

for i = 1,2,...,34 and t = 1982 to 1990,

where

$\hat{E}_{ijt}$ = projected employment in occupation "j" of industry "i" in year "t",

E_t = projected total employment of year "t" from CANDIDE solution,

Q_{it} = projected output of industry "i" in year "t",

Q_t = projected total output of year "t", and

$KINT_{it}$ = projected capital intensity of industry "i" in year "t".

It should be noted that "$\hat{b}_0$", "$\hat{b}_1$", and "$\hat{b}_2$" (unique to each occupation j) are the coefficients estimated in equation (1), while E_t and $KINT_{it}$ are obtained from a given CANDIDE 2.0 solution. Substituting these figures into equation (2) will yield the number of people employed in the jth occupation in each industry "i" in year "t". The total projected employment for the jth occupation, then, is simply the sum of all 34 industries' projected figures. That is,

$$\hat{E}_{jt} = \sum_{i=1}^{34} E_{ijt},$$

where "j" refers to the occupation in question, "i" the industry, and "t" a particular year in the projection period.

No attempt has been made here to introduce occupational employment back into the mainstream of CANDIDE. This use of the latter strictly as an external supplier of ex ante information has the simple advantage of being able to obtain an occupational employment projection at a fairly reasonable computing cost. The lack of two-way linkages between our model and CANDIDE, however, precludes any possibility of evaluating the impact of changes in occupational employment on the total economic system. As has been mentioned in the introductory chapter, however, no easy solution exists for modifying parts of any nationwide econometric model to reflect simultaneous changes in the occupational variables; it appears we will have to live without a feedback mechanism, at least for the time being.

c) Modified Canadian Occupational Forecasting Model (MODCOFOR)

To project future employment for those industry-specific occupations that CSSM cannot handle, MODCOFOR, which is a modified version of COFOR, is used. For operational convenience, however, the model is set up to cover the full array of occupations (496 four-digit CCDO occupations) found within the Canadian economy.[5]

MODCOFOR and, indeed, all fixed coefficient manpower requirements models, start with a base year employment-by-occupation-and-industry matrix in ratio form. Each coefficient within the matrix represents the occupational share of the respective industry's total employment. If we label this maxtrix "A", then its components are calculated as

$$a_{ij} = E_{ij}/E_i,$$

where a_{ij} = the fraction of employment in industry "i" which is accounted for by the employment in occupation "j" in the base year,

E_{ij} = the employment in the jth occupation of the ith industry for the base year, and,

E_i = the total employment of industry "i" in the base year.

In MODCOFOR, an occupational/industry coefficient matrix of 496 (4-digit CCDO occupations) by 35 (industries) is constructed,

based on 1971 Census and 1975 OES proportions.[6] The 35-industry dimension, rather than COFOR's original 69-industry breakdown, was employed to avoid operational problems, encountered by the builders of COFOR, in linking directly to the 35-industry structure contained in CANDIDE 2.0.[7] Then, in the next step of the exercise, we gained access to CANDIDE's series of projected industry employment, E_{it}, where "t" represents points of time in the projection period, and "i" refers to the industry in question, which runs from 1 to 35 in this case.

In the final stage of the projection exercise, we multiply the projected industry employment series, E_{it}, by the occupation-to-industry-employment ratios "a_{ij}", as established in the 1971 Census, to obtain the projected employment-by-occupation-and-industry values ($\hat{E}_{ijt}$), as follows:

$$\hat{E}_{ijt} = a_{ij} * E_{it} \text{ for } t = 1982 \text{ to } 1990.$$

The $\hat{E}_{ijt}$ are then summed across industries, for each year "t", to obtain, finally, the projected employment in occupation "j":

$$\hat{E}_{jt} = \sum_{i=1}^{35} \hat{E}_{ijt}, \quad t = 1982 \text{ to } 1990,$$

where $\hat{E}_{jt}$ = the projected employment in occupation "j" in year "t", and

$\hat{E}_{ijt}$ = the projected employment in the ith occupation of the ith industry in year "t".

(B) Job Vacancies: Estimation and Projection

The Unemployment-Job Vacancy Relationship

As has been mentioned earlier, Hansen (1970) has demonstrated the theoretical rationale for the unemployment-vacancy curve to be downward sloping and convex to the origin. Two of the simplest functional forms which satisfy this theoretical requirement are the downward sloping straight line and the rectangular hyperbola. In an earlier period when the unemployment-vacancy curve remained fairly stationary, it was found that the rectangular hyperbola fitted the data better.

Aside from a better fit, there is also a conceptual justification for preferring the rectangular hyperbola to other functional forms. Theoreticians have maintained that movements along the unemployment-vacancy curve indicate changes in deficient demand unemployment without any change in non-deficient demand unemployment. If this is the case then, conceptually, there should be a numerical value for the product (or the sum) of the unemployment and vacancy rates, which would stay constant along the curve, corresponding to the specific conditions. Mathematically, the rectangular hyperbola is

$$V = \beta_0/U,$$

where V, U, and β_0 are the vacancy rate, unemployment rate, and a constant parameter, respectively. The equation above can be

rewritten as

$$UV = \beta_0,$$

which says that the product of the unemployment and vacancy rates is constant along the rectangular hyperbolic curve. For instance, if V increases, then U must decrease by a specific amount to maintain the value of the product equal to the constant value of β_0. This describes perfectly the unemployment-vacancy thesis of a decrease in deficient demand unemployment without any change in non-deficient demand unemployment.[8] Thus the rectangular hyperbola is a logical specification, if not the only valid one, for the unemployment-vacancy proposition.

Given that we accept the rectangular hyperbola as the appropriate functional form for estimating the unemployment-vacancy relationship, the scatter diagram of Figure 1, based on 1971 to 1978 data, reveals only a vague downward-sloping relationship between the rates of unemployment and vacancy. The confused configuration of Figure 1 is, hypothetically, the result of a continuous shifting of the rectangular hyperbolic curve. This is a hypothesis, however, that requires empirical verification.

The validity of the unemployment-vacancy thesis depends crucially upon whether or not there exist identifiable forces

contributing to the lack of a clear pattern in Figure 1. That is,

$$UV = \beta_0 + f(\text{shifting parameters}).$$

This relation may then be logically expanded in order to explain what the shifting parameters in fact are, as follows:9

$$UV_t = \beta_0 + \beta_1 UICB_t + \beta_2 INDC_t + \beta_3 DEMO_t + e_t, \qquad (3)$$

where $UICB_t$ = weekly unemployment insurance benefits in year t ÷ average weekly earnings in year t;

$INDC_t$ = real domestic product in manufacturing in year t ÷ real domestic product in non-manufacturing in year t;

$DEMO_t$ = non-prime age male labour force in year t ÷ prime-age (25-54 years) male labour force in year t; and

e_t = error term in year t.

The first variable, $UICB_t$, denotes the shifting influence of the unemployment insurance legislation revisions in the early 70s. It is included in the equation because it is recognized as having some impact on unemployment,[10] that is "β_1" should be positive.

The next explanatory variable, $INDC_t$, the ratio of the real domestic product (RDP) in manufacturing to that in non-manufacturing, is used as a proxy for capturing gradual changes in the industrial composition. Since jobs in the manufacturing sector generally require a higher degree of skill training, licensing or union membership than those in non-manufacturing, an increase in the ratio of the corresponding RDPs is expected to shift the unemployment-vacancy curve outward, i.e. cause further worker/job mismatches; the associated coefficient, "β_2", is therefore expected to be positive. Finally, $DEMO_t$ is the ratio of (i) the difference between the total labour force and the prime-age-male labour force, to (ii) the prime-age-male labour force.[11] Variants of this demographic composition variable are experimented with in order to capture the impact of rapidly growing sex/age groups (e.g. females and youths) on the demand for and supply of certain workers. Growing participation by these groups is likely to push the UV curve outward: "β_3" is expected to be positive.

While the unemployment-vacancy equation is interesting in its own right, more to the point of this digression, it too serves as a means of projecting total job vacancies. That is, after the "UV" equation above is estimated, it can be re-arranged as

$$V_t = (\hat{\beta}_0 + \hat{\beta}_1 UICB_t + \hat{\beta}_2 INDC_t + \hat{\beta}_3 DEMO_t)/U_t \qquad (4)$$

Then we can use this equation, in conjunction with CANDIDE 2.0 projected information on the regressors, to project total vacancies.

A Mechanism for Projecting Disaggregated Occupational Vacancy Series

The estimation of vacancies at the detailed occupational level rests on two basic requirements, namely, a sound theory of job vacancy by occupation in order to specify each occupational vacancy equation separately, and a sufficiently rich occupational data bank for estimating the parameters in these equations. A theory of job vacancy by occupation, however, to the best of our knowledge, has not yet been developed, and, as far as occupational data are concerned, with the exception of the now-defunct Job Vacancy Survey's output, there exist virtually no usable time series. Like occupational employment, then, these two obstacles make it almost impossible to estimate occupational vacancies. Therefore, to generate occupational vacancies projections we will be forced to rely on a purely mechanical device that does not purport to be a theory of job vacancies. The procedure is as follows.

Given that we know from equation (4) future total vacancies of the economy, V_t, we will attempt to estimate v_{jt}, its occupational components, as a linear combination of the time trend and the total vacancies.[12] That is, for each occupation "j" we have

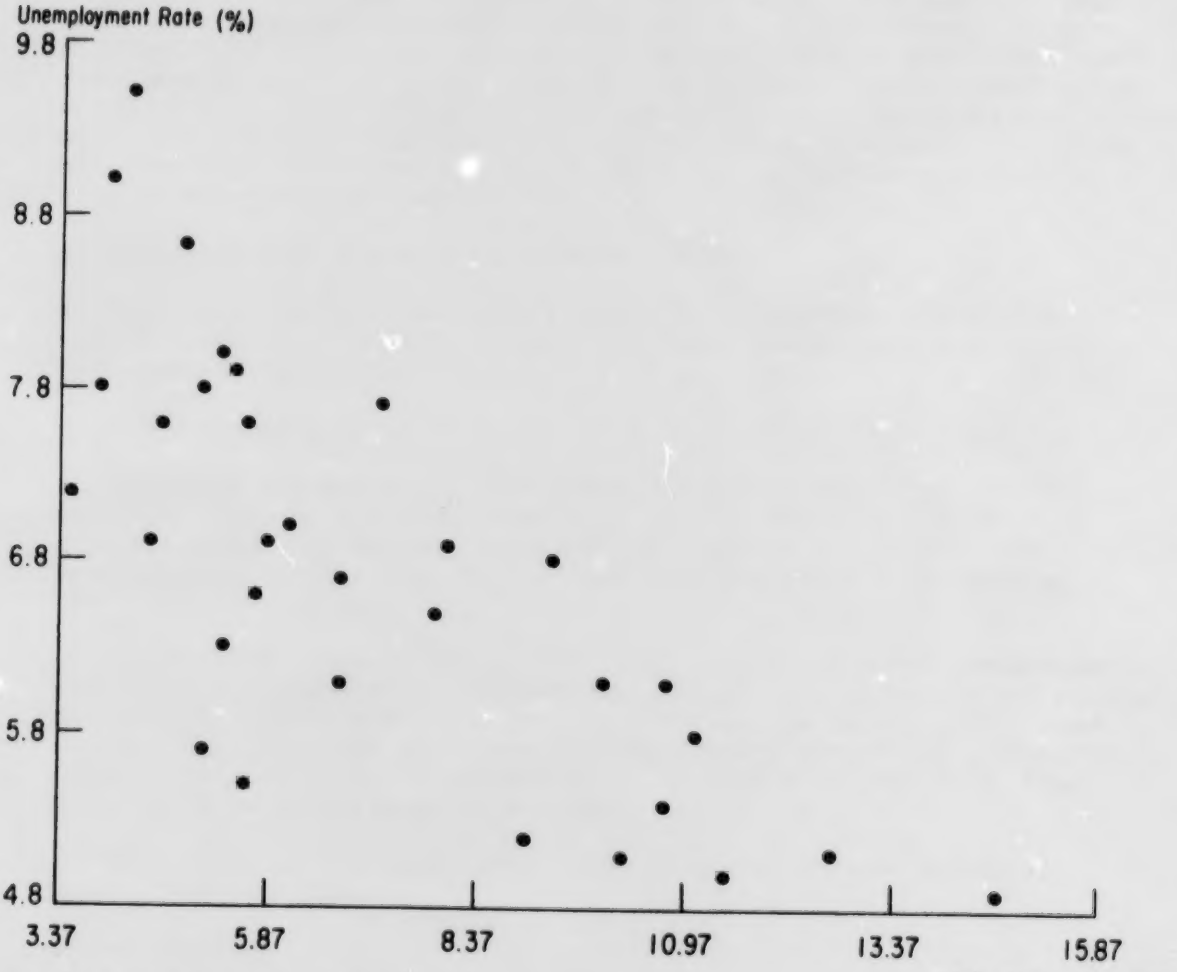
$$v_{jt} = \Gamma_0 + \Gamma_1 T_t + \Gamma_2 V_t + e_{jt},$$

where v_{jt}, T_t, V_t and e_{jt} are the vacancies of occupation "j", the time trend, total vacancies and the random error term, respectively, during each year "t" of the projection period.

The specified equation could be applied to both the three- and four-digit-CCDO occupations. At the four-digit level, however, the sample size for each occupation would be quite small and the data would then be subject to a large sampling error. Consequently, we decided to conduct our analysis at the three-digit CCDO occupational level only, the results of which are contained in the next chapter.

Figure 1

Unemployment Rate Versus Job Vacancy Rate, 1971-1978, Quarterly



Sources: Based on Statistics Canada's data.

Notes

Chapter III

1 This means that the 211 occupations successfully estimated and projected by CSSM will also be covered by MODCOFOR. These 211 sets of projected figures, however, will only be used for checking purposes, while it is the 211 CSSM projected series that will be reported in this study.

2 An industrial wage variable was originally introduced into equation (1) but was eliminated because wages and capital stock are, empirically, too highly correlated. Furthermore, it is difficult to interpret the resulting coefficient since the wage data are already ex post, that is, at a level established after workers have been attracted to that industry. Occupational wages would be a better variable for our purposes. However, the lack of wage data covering the full range of occupations precludes such a course of action.

3 See Economic Council of Canada (1980).

4 See next section for exact details on how the figure of 211 was arrived at. DAMSEL stands for Data Management and Econometric Language.

5 See footnote (1).

6 Appendix B indicates, for each industry, which of the two sources (Census and OES) the information was taken from. In actual fact, the source information used to construct the coefficient matrix for both COFOR and MODCOFOR is essentially the same.

7 Apart from reasons of convenience, a 35-industry breakdown was felt disaggregative enough to capture the majority of worker movement. COFOR's 69-industry breakdown, we felt, restricted worker mobility too much within one finely specified industry. Also, the reason for MODCOFOR's using one more industry than CSSM's 34 is explained in Appendix B.

8 Note that if an intercept term is added to the original specification, then

$$V = \beta_0 + \beta_1 / U ,$$

which implies

$$UV = \beta_0 u + \beta_1,$$

Therefore the argument presented above would no longer hold.

9 When UV is the regressand, the right-hand-side regressors are, of course, variables. However, in the context of our discussion the regressors can also be called shifting parameters: once the values of the regressors are given, they will add to or subtract from β_0, thus forming a new constant; this means that the "UV" curve has shifted.

10 See, for example, Grubel, Maki, and Sax (1975).

11 The prime age male labour force is composed of those labour force males 25-54 years of age.

12 At an earlier stage in the analysis, V_t lagged, that is, V_{t-1}, was used as the regressor. The advantage of this is that the regressor no longer contains the regressand. It turned out, however, that neither the goodness of fit nor the ex ante projection capability of the V_{t-1} approach is as good as the one with contemporaneous V_t. At the final estimation stage, an instrumental variable was used to check the degree of simultaneity bias introduced by the V_t term. Further discussion of this topic can be found in the empirical results chapter of this study.

Chapter IV Empirical Results

In this chapter, we will look at both historical evidence and our own calculated results to finally come to grips with the problem of measuring occupational demand. In section (A) we will report actual statistical information in order to verify highly publicized claims of hiring difficulties - one of the reasons for a study of this kind. Then in section (B) we will present the results of our own estimation exercise, based on historical data. Included in section (C) is a discussion of the evolution of industrial employment and labour market tightness. In the final section of the chapter we will publish our projected results, based on macro scenarios available in 1981, at a fairly disaggregated occupational level. Because the whole estimation and projection exercises generated an enormous amount of information, only the salient points and summary statistics are included here.[1]

(A) Evidence of Vacancies

The issue of skill shortages has recently attracted much attention from the press, politicians and analysts alike.[2] However, aside from a few surveys of limited scope, information on the exact dimension of the problem is practically non-existent. For the most part, our knowledge of its severity is anecdotal and qualitative in nature. In this section, we will try to check employers' claims of skills shortages against detailed occupational vacancy data. The task of matching these two bodies of

information is, we feel, important: if, in fact, no historical consistency can be found between them, we might well question the pleas heard from employers for more highly skilled workers.

Our approach was, first, to compile a list of occupations found by the Human Resources Survey (HRS)[3] to be most frequently in shortage situations over the 1977-79 period and then to compare these results to the only statistical measure of vacancies available, namely the Job Vacancy Survey (JVS). The HRS was utilized because it was, we felt, fairly representative of employers' hiring experiences and requirements. In fact, the results from that survey closely paralleled the findings of a qualitative search conducted by Leckie (1981) of relevant newspaper clippings and other survey efforts in the late 1970s. For these reasons we felt HRS shortage occupations to be typical of actual areas of labour shortage in Canada.

Table 1 contains the results of the comparison of HRS and JVS data for selected blue collar and white collar occupations. On the whole, a fairly high degree of correspondence emerges from that exercise. Specifically, we observe that, in the fabricating/repair area, which the HRS reported as a group to have been most frequently in shortage situations (with over 20 per cent of the Canadian total), the four higher skilled occupations noted there do in fact show up as commanding a fairly significant proportion proportion of total JVS vacancies as well. Two of

these, machinery mechanics (including millwrights) and equipment electricians, have also displayed greater than average vacancy growth during the 70s -- possibly a reflection of the accelerating mechanization of industry. On the other hand, the remaining two HRS shortage occupations in this group, motor vehicle mechanics and sewing machine operators, exhibited a reduction in vacancies according to the JVS. Though still large in terms of overall numbers, the slow vacancy growth performance of the latter two occupations may be attributed to the declining and increasingly automated car and textile industries.

According to Table 1, another occupational area in which employers appear to have experienced notable hiring difficulties is machining, comprising over 13 per cent of the national total. Individually, machinists, welders, tool and die makers and, to a lesser extent, machine tool operators have all displayed a rather large share of total HRS shortage situations. These results are corroborated by the correspondingly high share and growth of JVS vacancies. Again this may be a function of the increasing application of machine technology to industry -- though this time in a machining capacity: using tools and machines to shape raw materials, compared to actual assembly and repair of the finished product as described earlier.

The next area we looked at is the business and personal service occupational group where chefs and cooks, food servers and janitors were all identified by the HRS to have been in short

supply relative to employers' requirements from 1977 to 1979. However, this result is only partially confirmed by JVS data which show, among the four service jobs presented in Table 1, just chefs to be in a particularly strong position as far as both share of, and growth in, total vacancies are concerned. Though food servers and janitors were among the more prominant JVS vacancy occupations in terms of share, their growth during the 70s was below the average for all occupations.

In the last two blue collar categories in Table 1, JVS data also do not unequivocally back up what the HRS found. For instance, in the construction trades, excavators/graders, plumbers/pipefitters and carpenters were pinpointed by the latter to be fairly weak in supply: 1.2, 0.9 and 0.8 per cent respectively of all HRS hiring difficulties were in these three trades over the 1977-1979 period. Yet, the JVS reported them not to have been in particular bottleneck situations in 1978 and during the 70s their annual rate of growth in vacancies was at or below zero.

Finally, in the processing trades, too, a small degree of commonality exists between the HRS and JVS results: whereas meat cutters' share of HRS shortage situations is a fairly substantial 1.0 per cent, their share of JVS vacancies was only 0.3 per cent with no appreciable growth in vacancies recorded over the 1970s. As for moulders, while their share of HRS hiring difficulties was a mere 0.3 per cent, the rate of growth reported in JVS vacancies

from 1971 to 1978 was close to 14.0 per cent, well above average.

Turning now to the survey comparisons for white collar occupations in Table 2, the HRS found that employers had experienced major hiring difficulties in science and engineering. In fact, it was the most frequently cited problem area among white collar positions, and third overall, occuring in almost 13 per cent of all HRS shortage situations. Individually, we observe that four categories of engineers -- industrial, mechanical, electrical, civil -- and also engineering technologists all appear to have been in an advantageous position as far as excess demand is concerned, a fact that is backed up by vacancy share and growth data generated by the JVS and reflective of the spread of high technology. Likewise, systems analysts/programmers seem to have played a rather strategic role in the economy of the 70s, which is not surprising given the influence computers have exerted in all sectors of industry during the same decade. Finally, drafters have been identified both by the HRS and JVS to have been in situations of substantial unmet demand.

A number of managerial occupations, too, were in shortage situations. In particular, the HRS found that accountants occupied 2.0 per cent of hiring difficulties, a result corroborated by the JVS. In addition, that profession enjoyed a 25.7 per cent annual growth in vacancies during the decade of the 70s. As for the other managerial occupations noted --

production, financial, sales -- the smaller shares of total HRS shortage situations appear to correspond fairly closely to the fractional JVS vacancy shares. Still, according to the latter, vacancies in all four management-related occupations have grown at a rather substantial rate throughout the 70s. This parallels also the findings of Leckie (1981) which showed that the demand for managers to supervise various aspects of newly constructed projects had greatly increased -- particularly out West and particularly in the latter part of the last decade.

Specific occupations within the two other main categories of Table 2 -- clerical and sales -- have also been cited by the HRS to be areas in which employers have had difficulty finding sufficient numbers of workers. Among the former, secretaries have been the most frequently in shortage situations, a fact that comes out much more strongly in JVS results where 4.1 per cent of all vacancies were in secretarial positions in 1978. Furthermore, the growth in secretarial vacancies remained above average -- despite innovations in this field that would lead one to expect the opposite result. Finally, in sales we see that employers had experienced a lot of difficulty in hiring supervisors of commodity sales, a fact that is not necessarily substantiated by the JVS: 0.4 per cent share and -6.0 per cent annual growth of vacancies. On the other hand, technical sales persons, though not appearing to have been in particular (HRS) shortage situations, nevertheless demonstrated a rather large annual increase in JVS vacancies. As Leckie (1981) found, this is

not hard to understand, given the growing need to market the fruits of the microtechnological revolution.

On the whole, then, employers' hiring experiences in the late 70s, as reported by the Human Resources Survey, appear to be grounded in fact if we may use the Job Vacancy Survey as a record of actual events of that decade. For indeed, as we saw, many of the occupations specifically identified by the HRS to be lacking sufficient workers were also positions that the JVS found to exhibit a fairly substantial share of and growth in vacancies. In particular, occupations in fabricating/repair (like machinery mechanics), machining (like tool and die makers) and science and engineering (like systems analysts) came though strongly in both the HRS and JVS. To a lesser extent, we found that the two surveys agreed in the clerical and managerial areas. Finally, few parallels were found in service (except chefs), construction, processing (except moulders) and sales (except technical salespersons).

(B) Estimation of Occupational Demand

(i) Estimation of Occupational Employment by CSSM

Following the typical specification for the cross-section-stochastic model (CSSM), in equation 1 of the previous chapter, 1971 data have been used to estimate the parameters of the relevant four-digit CCDO occupational employment equations. In

some cases, where the four-digit classifications were judged to be of little value on their own, the corresponding three-digit aggregate was used. Then, of the remaining 492 three- or four-digit occupations in question, 41 were eliminated out of hand either because they were obviously concentrated in one or two industries and, therefore, not suitable for the CSSM specification, or because, in some cases, (e.g., CCDO occupation 2513, nuns and brothers) they did not lend themselves to conventional labour market analysis.

Out of the 451 occupations attempted, CSSM succeeded in empirically establishing functional relationships for 211 of them through the use of the ordinary least squares technique and the associated F tests and t statistics criteria.[4] The use of cross-sectional data, however, can introduce problems of heteroskedasticity: in this case, the size of the industry may be related to the size of the variance in the associated disturbance. To test for this possibility, Glejser's test was applied to the 211 equations, as described in Glejser (1969). Those relationships exhibiting hetroskedastic tendencies were then re-estimated using the generalized least squares technique proposed in the same publication.

(1) Ordinary Least Squares (OLS) Estimates

The model works quite well for all occupations included in the managerial administrative and related category. The equations

estimated by the ordinary-least-squares technique have corrected coefficients of determination ($\bar{R}^2$) between 50 per cent to 70 per cent. Since these equations have been estimated by using cross-section data, and since the number of explanatory variables has been limited to two at most,[5] the amount of variation in the dependent variables explained by the regressors appears to be fairly large. For the managerial, administrative and related occupations group, with the exception of three occupations, namely, general managers and other senior officials, sales and advertising management occupations, and personnel and related officers, the capital intensity variable does not turn out to be statistically significant. The signs of the first two are negative and the third is positive. This latter case suggests the validity of the fixed technical coefficient argument which posits fixed proportions of certain types of labour and capital inputs in certain types of production. The output share variable prevails in all of the equations included in this broad category, which confirms our expectation of its role as the main driving force for the formation of the occupational employment distribution.

The specification also works reasonably well for the major group of occupations in the natural science, engineering and mathematics category. There are thirty occupations classified in this group, and 24 of them can be said to have significant functional relationships (according to the criteria set earlier) between the dependent and explanatory variables. Like the managerial group,

the output share variable is statistically the strongest explanatory variable. The capital intensity variable is significant only in the equations for physical sciences technologists and technicians, biologists and related scientists, civil engineers, electrical engineers, nuclear engineers, architects and engineers not elsewhere classified, architectural and engineering technologists and technicians, and mathematicians-statisticians-actuaries. In all cases, the coefficients for the capital intensity variable are positive. This may be due to the necessity of having highly trained professionals to operate the capital equipment.

For all occupations in the social sciences and related fields, the specification succeeds in establishing functional relationships, with the exception of one highly specialized and concentrated occupation, namely judges and magistrates, which is found only in the public administration sector. The signs, sizes and significance of the estimated coefficients of the accepted equations display patterns similar to those exhibited by the previous two occupation groups. Finally, the other major groups that are adequately described by CSSM are occupations in medicine and health; artistic, literary, recreational and related occupations; clerical and related occupations; service occupations; and construction trade occupations.

In conclusion, CSSM has been able to establish functional relationships for close to half of those four-digit-CCDO occupations

which we found relevant for labour market analysis. Obviously, some important occupational fields have been left out by CSSM, such as sales, transportation, farming, fishing, forestry, mining, processing, machinery and fabricating and these will be estimated by MODCOFOR.[6]

(2) Generalized Least Squares (GLS) Estimates

As we said earlier, all of the 211 CSSM occupational employment distribution equations estimated by the ordinary least squares technique have been subject to Glejser's tests for heteroskedasticity. According to Glejser (1969), the absolute values of the residuals obtained from the previous OLS estimates are regressed, using several plausible functional forms, on those variables with which the variance of the error term is suspected of being correlated. Whether or not heteroskedasticity exists, therefore, depends on whether or not these estimated coefficients are shown to be significantly different from zero.

The statistical tests revealed that, in fact, more than 90 per cent of the equations estimated by OLS showed some signs of heteroskedasticity and these were therefore re-estimated by the generalized least squares (GLS) technique.[7] We have found that the GLS technique does not invalidate the functional relationships previously established by OLS, but that the "t" values and the sizes of the estimated GLS coefficients are generally smaller than their OLS counterparts. Even though these findings are consistent

with econometric theory,[8] their usefulness as an instrument of projection is still uncertain. At this point, it suffices to indicate that we have used both the OLS and GLS equations to produce two independent sets of projections under identical economic scenarios and assumptions, covering the period 1981 to 1985. Obviously, we have no way of knowing now which set of projected figures will turn out to be more accurate in the future. However, in using the 1971 actual observations as a reference point, we have come to the conclusion that, with few exceptions, the projected figures based on the GLS equations appear to be on the low side while those estimated with OLS look more plausible.[9]

(ii) Estimation of Occupational Employment by MODCOFOR

As has been mentioned earlier, only 211 out of the total of 497 four-digit CCDO occupations were estimated by the CSSM model. The rest were handled by a fixed coefficient employment technique, namely MODCOFOR. As nothing of interest can be added to the methodological description of this model in Chapter 3, we will turn to the estimation of vacancies.

(iii) Estimating Job Vacancies

In the previous chapter we presented a scatter diagram (Figure 1) plotting the job vacancy rate against the unemployment rate over time. It was postulated that the barely recognizable

downward sloping curve detected there was due to "continuously shifting forces" and we formalized this concept in equation (3). In this section we report the results arising from empirically testing that hypothesis. We found that the first two regressors, namely the unemployment insurance variable (UICB) and the industrial composition variable (INDC), had the expected impact on the regressand, UV, both exerting positive influences on the unemployment-vacancy trade-off, i.e., job-worker imbalances. On the other hand, demographic composition (DEMO) was statistically significant only if INDC was dropped from the equation.[10] This implies that these two variables may be closely related; both, then, should not have been included in the same equation. In fact, in the projection phase we did drop DEMO to avoid this problem of collinearity. At any rate, industrial composition and demographic composition are likely conceptually related, since jobs created in the service sector (non-manufacturing) are more suitable for the growing number of female and youth entrants to the labour force.[11]

The unemployment-vacancy equation (3) was estimated by both the ordinary least squares and instrumental variables methods. This is because the regressors of the equation, which were treated exogenously in our system, are actually endogenous in the context of a total economy. The instrumental variable method was used to check the possibility of a simultaneous bias in the estimated coefficients.[12] It was found that in both cases the equations estimated by the instrumental variable method were slightly

different from their OLS counterparts, but the differences were not large enough to rule out the usefulness of the OLS equations as tools for the projection exercise.

Using the estimated "UV" equation, in conjunction with the actual observations, a set of rectangular hyperbolas were then estimated and plotted for selected years in Figure 2. It can be seen that the combined forces of the shifting parameters have continuously moved the "UV" curve in and out. This is understandable, as we do not expect structural and frictional unemployment to stay constant over time. The overall impression is that the curve was shifted away from the origin appreciably between 1971 and 1975. However, a new development emerged during the 1975-78 period. It is seen that during these years the "UV" curve gradually moved back towards the origin. A re-examination of the estimated equation and the data confirmed that this was due to the fast growth of the non-manufacturing sector which was more than enough to compensate for the detrimental effect of UICB on frictional unemployment. In other words, the relatively fast growth of the non-manufacturing sector in the 1971-78 period, especially in 1975-78, helped to smooth the functioning of the labour market. Unfortunately, no observed data for job vacancies are available since 1978, and therefore we cannot make any firm statement concerning the mismatching problem for the post 1978 period. In the latter part of this chapter, we will discuss the overall picture of the unemployment-job vacancy relationship for the 1978-90 period, based on projected figures.

(C) Background to the Projections

General Economic Climate for the Projection Period

By way of setting the scene, the source information for our current projection of labour demand by occupation was drawn from the base case solution of CANDIDE 2.0, September, 1981.[13] Essentially, this is a "middle-of-the road" type economy projected by the Economic Council of Canada's macro econometric model at that time.[14] The basic assumptions that are used are as follows.

The United States is expected to experience 3.1 per cent annual real growth during the 1982-85 period, and 2.9 per cent for the 1986-90 period. These rates are a substantial drop from the 3.5 per cent average recorded between 1956 and 1975. In addition, the U.S. unemployment rate will decline slightly from the present level throughout the 1982-90 period. For the Canadian economy, the CANDIDE 2.0 projection produces an economic climate that looks brighter than the experience of the 1970s. For instance, the unemployment rate is lower than that of the previous decade. Also the average inflation rate is only slightly higher that the average of the 1974 to 1979 period. Real economic growth in terms of goods and services produced by the economy is only 0.3 of a percentage point lower than in 1974-1979, but is about 1.5 percentage points lower than the 1969-1979 average. Labour force growth is about one percentage point lower than the average growth rate of the last two decades. Finally, employment is projected to

grow strongly for 1982-1983, but its growth will decline gradually for the remainder of the decade.

When the projected general economic climate changes, all of the projected labour demand by occupation figures will, of course, be altered. The degree of sensitivity is, however, not large. This is because the ripples generated by the change of the general economic scenario have to be distributed among a large number of occupations. Therefore, as long as the change in the economic climate is not dramatic, a minor change will not have a significant influence on the projected occupational demand figures presented here.

The Evolution of Industrial Employment Composition

In this section we will present a statistical picture of the evolution of industrial structure over time. Figures for the 1971-1981 period are calculated from observed data, whereas 1982-1990 figures are projected.[15] The detailed information on all industrial sectors is contained in Appendix B, whereas we will attempt here to present only an overall view of developments in three important sectors, namely the primary industries, the manufacturing sector and the services.

Historically, with the exception of mining, all of the primary industries, including agriculture, fishing and trapping, and forestry, shared a common feature: a lack of employment growth

and a decline in employment share. In fact, the year-to-year employment growth for agriculture, and fishing and trapping has often been negative since 1971, while their employment share has declined. Forestry employment growth was volatile. However, from the employment share figures, we can see that, relative to total employment, forestry employment as a proportion of the total has also declined since 1971. This historical picture for the primary industries is projected to be approximately the same for the decade of the 1980s.

As an aside, it might be interesting to observe what the corresponding output figures for the primary sector were/will be. The real output of agriculture, fishing and trapping enjoyed an average growth rate of 1.7 per cent per annum for the period of 1971-1980; the corresponding figure for forestry was 2.3 per cent. In the medium term future, agriculture, fishing and trapping are not projected to have any significant growth in real output, but forestry is expected to have a real output growth rate that is well above the national average. In other words, there appear to be major discrepancies in the growth of output and employment and we can only attribute these differences to technological change which has made it possible to produce more output with less labour inputs -- at least in the primary industries. This would not necessarily be a bad development if the surplus labour could be located somewhere else. Attrition through old age retirement has surely accounted for some of the dwindling numbers in these sectors, but this is a slow process and cannot explain all of the

decline in employment. Therefore we can safely conclude that some workers must have left the labour force for good. Workers from these industries are generally equipped with specialized skills which are not readily transferable to other sectors of the economy. Consequently, extensive retraining and labour market monitoring, financed and supported by all levels of governments, may be required to help them to make the transition.

Mining is a special case among the primary industries. The industry's employment growth was extremely volatile up until 1974, but has been stabilized at a healthy growth rate of 4 per cent per annum since the mid-70s, and reached a phenominal rate of 15.4 per cent by the year 1980. Its employment share, unlike the other primary industries, stayed relatively constant for the 1970s, and is expected to rise substantially in the current decade.

Manufacturing remains a sector that baffles politicians, policy markers, and analysts. While it is still a significant sector of the economy, it has not been a major force in absorbing the ever growing numbers of new labour force entrants since the early 1960s. Its rate of employment growth has been erratic and sluggish: 2.3 and 2.0 per cent per annum for the 1960s and 1970s respectively. These rates were substantially lower than the national averages for the same periods. The employment share statistics indicate that manufacturing's share of the total employment dropped from about 24 per cent in the mid-60s to slightly more than 20 per cent by the end of the 70s. The outlook for the future should be more or less of the same.

It is interesting to note that in the early 70s, manufacturing was predicted to have very slow employment growth for the remainder of that decade and the reaction from many quarters at the time was that the figures seemed implausibly low. Very few realized that these forecasts were consistent with a trend established in the 1960s. In fact, they turned out to be correct. The lesson is that, unless there a drastic structural change in the next ten years or so, we cannot expect employment in the manufacturing sector to grow at a better than the national average rate and to absorb the predicted increase in new labour force entrants in the 80s. The recent cries of skill shortages heard from this sector should be treated with extreme caution. Although shortages undoubtedly exist in scattered pockets of the industry, the number of vacant jobs involved overall will be relatively small. Therefore an overdose of policy measure in this area could have the deleterious effect of misleading many members of the labour force to overrun a rather small specialized labour market for many years to come.

If employment growth will not be strong in manufacturing, then where can we expect the majority of an ever-growing labour force to be located? This leads us to look at the service sector, defined here to include transportation and communication; electric power, gas and water utilities; trade, finance, insurance and real estate; community, business, and personal service; and public administration. It should be noted that within this sector variations among industries are quite significant. Readers

interested in detailed information for a particular industry should consult the figures presented in Appendix B, but for the sector as a whole, the annual employment growth rates were 4.2 and 3.6 per cent for the 1960s and 1970s, respectively. These figures are only marginally higher than the corresponding figures for mines, quarries and oil wells, but are substantially higher than the ones for all of the goods producing industries. The employment share statistics are even more revealing. The service sector only accounted for 54.8 per cent of the total employment in 1960. For two decades, this figure continued to climb monotonically and by the end of the 1970s, the service sector alone provided about 66 per cent of the jobs in Canada. This trend is projected to continue until the end of the 80s.

The relatively fast growth of the service sector has undoubtedly helped to smooth the functioning of the labour market in the 70s. During that period, the unemployment rate reached a level that was about 2 percentage points higher than what it was in the 1960s. The swell of young people and women into the labour force has often been blamed as one cause of this poor performance.[16] Little has been said, however, about the fact that the situation would likely have been worse had the service sector not grown strongly enough to absorb a substantial portion of this influx. A similar bright picture can be expected in the next decade as well. This optimism, however, is guarded, based, as it is, on the assumption that labour force members will be sufficiently flexible to adapt themselves in jobs that will be significantly influenced by micro

technology. As we said, a large number of youths and women will be located or looking for work in the service sector. These are just the types of people who traditionally have little investment in human capital, and little seniority in the working world. Therefore they should be more adaptable to technological change than other more established members of the labour force, for instance, older workers and prime-age males. As far as the quality and nature of the new employment opportunities are concerned, however, it is difficult to predict whether or not so-called high technology will reduce most work to an uninteresting button-pressing chore, and what influence it will have on the wages and salaries of these workers.

The Tightness of the Future Labour Market

Within the context of the economic environment described above, how tight is the labour market? Traditionally, economists have looked at the unemployment rate, and obtained a quantitative indicator for this elusive concept. This approach has been generally rejected in recent years,however, on the grounds that the nature of the unemployment rate has changed, and what was five per cent unemployment in the 1960s does not entail the same economic implications as the five per cent of more recent years. Indeed, this was the theme of Chapter 10 of the Council's last major study of the Canadian labour market, People and Jobs.[17] In discussing the message of the unemployment rate, we concluded that

basic changes in the nature of the market had also changed the message. And we recommended that supplementary information is needed for a balanced interpretation of labour market performance.

As has been mentioned earlier, the "UV" curve itself is subject to shifting forces continuously. Therefore, the observed and projected unemployment-vacancy data by themselves are not capable of telling us how tight the labour markets are in an inter-temporal setting. What is needed is a device to distinguish the cyclical swings from the structural shifts throughout the period of 1970 to 1990. This involves locating a "UV" curve and the exact location of the "UV" product on that curve for each one of those years. The resultant "UV" map is presented in Figure 3. It can be seen that from 1971 to 1975, the "UV" curve tended to shift outward. The curve for 1971 is closest to the origin, and the one for 1974 is the furthest. However, the curves for 1975-1980 period exhibited a tendency to move back closer to the origin. Using the projected figures, we can approximate the "UV" curves for the decade of the 80s. Generally speaking, the mismatching of people and jobs for the medium term future, which is indicated by the distance between the "UV" curve and the origin, will be similar to 1976 and 1977, but not as good as 1971. This is to say, the degree of difficulty in matching people and jobs in the 1971-1990 period can be said to be lowest in 1971 and highest in 1974. 1972, 1973 and 1975 were also years of substantial

difficulty. In the second half of the 1970s and the decade ahead the situation was and will be similar.

The discussion above deals exclusively with the degree of maladjustment in the labour market. It says nothing about the tightness of the labour market. Recall that a movement along the unemployment-vacancy curve is an indication of a change in deficient demand unemployment, whereas a change in non-deficient demand unemployment entails a shift of the curve. Therefore, a particular year's labour market tightness due to insufficient demand is revealed by its "UV" product's relative location on its particular "UV" curve. For instance, if we draw a 45 degree line from the origin, and assume it to represent an average degree of tightness,[18] then we can infer that 1974 represented the year of the tightest labour market, because its relative position is furthest away from the 45 degree line. By similar reasoning, 1978 was a year of "slack".

For inter-temporal comparison, only additional rays from the origin are needed. Join the origin and the points of 1974 and 1978 and the boundary of the tightest and slackest market conditions are defined. A straight line that joins the origin and the point of 1976 indicates that the years of 1976 and 1979 had a similar degree of labour market tightness. This is because the two points representing the two years are on the same ray from the origin. The fact that they are on two different "UV" curves is immaterial in this context, because the two different curves only

indicate two different degrees of maladjustment in the labour market, and have no relevance to the tightness of the labour market issue. Points to the left of the 1976 ray represent years of a tighter labour market, and points to the right the slacker markets. Thus, the rays from the origin, in conjunction with the "UV" curves, are a device for inter-temporal comparison. On the basis of this methodology, it appears that the labour market for the 1982-1990 period may not be as tight as that of the market of, say, 1973-1974. It is expected to be more or less comparable to 1975, but slightly tighter than that of the years of 1977 to 1980.

(D) Projection of Occupational Demand

(i) Projected Occupational Vacancies

We now turn to a discussion of the future course of occupational job vacancies. Using the projection model described above in some detail and projected information from the macro model, vacancy share and growth figures for the 1981-1985 period were generated at the 3-digit occupational level.[19] A complete statistical summary can be found in Appendix C, while a selection of these results is presented in the next three tables.

The first one, Table 3, contains occupational areas expected to display above average growth and share of vacancies. Those trained in such areas could be expected to command fairly advantageous positions as far as hiring and compensation are concerned.

The table reports the growth and shares of 13 3-digit occupations, but for demonstrative convenience we will comment on only a few of them. First, the appearance of "other" engineering and architectural occupations on a high growth/high share list is hardly surprising, given the role that these occupations -- surveyors, drafters, technologists and technicians -- will undoubtedly play in the construction of the upcoming energy-related projects. Likewise, it was not totally unexpected to observe large projected vacancy growth and vacancy shares associated with a number of metal-related occupations. The increasing emphasis on machine technology now being witnessed in industry will undoubtedly exert excess demands in all relevant occupations, including processing (e.g., smelting), machining (e.g., tool and die making), shaping (e.g., forging), fabricating (of, e.g., business machinery and precision instruments), and repairing (e.g., mechanics). In addition, the increasing use of high technology electronic equipment manifests itself in the strong growth and share of vacancies in electrical and electronic products fabricating, assembling and installing occupations.

The next group of occupations we look at in Table 3 are "other" construction trades, a group which includes carpenters, masons, painters, pipefitters and glaziers -- in fact all construction-related jobs except those associated with excavating and electrical power. The fact that a number of construction projects in the West are expected to start up no doubt contributes to the

healthy growth and proportion of vacancies projected for these occupations.

Another group in which we project that employers are going to experience difficulty in recruiting suitable numbers of workers is the service area. We found within this group at least two areas which will be particularly hard hit. One is protective services. The other bottleneck area in the service occupations is food and beverage preparation which includes chefs, bartenders and waiters -- all jobs associated with a seemingly growing hospitality industry.

Turning now to Table 4, we report occupations whose growth in vacancies will be well above average in the 1981-85 period, but whose share of total vacancies should be small compared to those of Table 3. What this means is that, though the economy will continue to have difficulty producing enough workers in these occupational areas, their relative significance as a potential bottlenecks may not be great. Briefly, we see that office machine and electronic data processing equipment operating occupations should exert strong growth in vacancies, which is not altogether unlikely given the popular use of automation on the shopfloor and in the office. What is surprising, however, is this group's relatively small vacancy share, although, at 1.3 per cent and growing, this occupational group should show increasing hiring difficulties in the more distant future. Another interesting occupational area is lodging and accommodation occupations

which will probably exhibit a fairly large annual increase in vacancies up to the year 1985. Despite this inability to attract suitable numbers of workers at rate above the national average, then, this occupation's proportion of total vacancies will remain relatively small.

The remainder of the occupational areas contained in Table 4 are, again, those in which employers should experience hiring difficulties, with the impact of such difficulties not posing a serious threat to the functioning of the economy. Notable among these we found wood machining (835) paired with wood products assembling and fabricating (854); clay, glass and stone machining (837) and fabricating (857); and "other" machining (839) and fabricating and repairing (859), including occupations in the areas of marine craft and paper. The appearance of this wide range of manufacturing trades on a future high vacancy growth list underlines the lack of skilled tradesmen in general in this country.

Finally, in Table 5 we present all those three-digit occupations which will average a fairly large share of total vacancies in each year up to 1985 but whose growth in vacancies will be at or less than the mean. While their significance is great, then, we do not foresee hiring difficulties in these areas worsening during the next few years. For instance, we see that "other" managers and administrators (not unique to government, such as financial, sales and production) and occupations <u>related</u> to management and administration (such as accountants and personnel officers) should occupy

a significant portion of total job vacancies -- particularly the latter. Apparently, however, the gap between the managerial needs of employers and the number of managerial graduates in the upcoming years should stay fairly constant. Likewise, unfilled architectural and engineering jobs will be large in number but should not grow in number any faster than the mean. A similar pattern holds for nurses and therapists as well, implying that, at least in these occupational areas, the labour market should not lag any further behind in filling vacancies compared to all occupations in general.

This concludes the subsection on projected occupational vacancies. We have seen that a number of occupations associated with engineering and the metals industry should exhibit both strong vacancy growth and a large share of total vacancies at least till the mid-80s. This result was not totally unexpected, however, in light of current technological advances -- a trend that shows no sign of abating. Next, we observed another group of occupations projected also to display strong vacancy growth but whose share of total vacancies is not expected to be large. Examples included office machine and EDP equipment operators and lodging and accommodation jobs. While vacancies in such occupations should continue to grow, their significance as potential bottlenecks in the immediate future is not great. Finally, in another category of vacancy occupations were included those whose share was rather large but not expected to increase too rapidly in the near future. Vacancies in, for example, some managerial and

engineering support positions, then, should remain relatively large though are not expected to grow faster than the average for all occupational categories.

In the discussion above, we have used the term vacancies and shortages interchangeably. Some theoreticians may object to this practice. In the strictest sense of the term, a true shortage means that, in a nation-wide setting, the supply of a certain class of workers is less than the demand for the same type. Thus, it is possible to have some vacancies, while true shortages do not exist. For instance, it is possible that there may be one hundred unemployed carpenters in city "A" while at the same time ninety-nine vacancies for carpenters in city "B". This is, of course, a labour mobility issue rather than a shortage problem. This fine distinction of problems is conceptually commendable, but, in practice, not helpful. This is because a person's occupation is always in a state of flux. An electrical engineer can be a computer analyst at some point in time, and a business administrator at some other time. Furthermore, labour supply by occupation data have never been available on a time series basis at sufficiently useful levels of disaggregation, and the labour supply by occupation ex ante information has never been meaningfully available.[20] Any attempt to approach the shortage issue from the global demand and supply point of view is futile.

We have used the Job Vacancy Survey data to develop an instrument for projecting job vacancies by occupation. Since this is

the first time that the data are available to us, some of the information revealed by them appear to be somewhat surprising, leading us to the conclusion that they may not be of the utmost quality. Despite these misgivings however, we believe that the JVS data should not be set aside too easily, because observations obtained from direct survey are, as a rule, more reliable than manufactured data. Moreover, it is our opinion that the Job Vacancy Survey should be revived in the near future. Of course, some of the technical problems in the old survey should be dealt with, and the dissemination method improved.

(ii) Projected Occupational Employment

As discussed earlier, there are two aspects to total occupational demand with which we must deal. The first is the unrealized portion - vacancies - which was, of course, the subject of the previous section; the second is the realized component, occupational employment, which will concern us here.

In Table 6, we report employment growth rates, projected to the year 1985, for a number of high (above the annual average of 2.7 per cent) growth occupations. Appendix D provides a complete summary of our occupational employment projections. The information contained in these tables can be highlighted as follows.

. Managers, administrators and related occupations (113) -- a category which includes managers, administrators, and other management related occupations in public administration, education and health services, and other service industries, but excludes officials and administrators unique to government (e.g., post-masters) -- are expected to grow at a rate that is slightly lower than the national average for 1981-1985.

. Accountants, personnel and related officers, and other occupations related to management and administration (117) will grow at a pace that is only slightly faster than average, although they will enjoy a fairly substantial share of total employment.

. Engineers and engineering technologists/technicians (code 216) should register substantial annual employment growth (3.2 per cent) in the next few years. Another important area comprises occupations in mathematics, statistics and systems analysis (code 218) a field which, according to our projections, should record above average employment growth until 1985. Again, this is understandable, given the remarkable expansion of the information computer industry.

. Employment for social scientists and social workers (231, 233) will grow at a rate slightly lower than average over the next few years, as will employment for occupations in law and jurisprudence (234), physicians, dentists, veterinarians and other diagnosing and treating occupations (311).

. Teaching and related occupations (271, 273, 279) will likely experience a decline in their employment levels for the 1981-1985 period. This bleak outlook for the teaching profession is due to the expected decline in the school-age population for the medium term future.

. Nursing, therapy, and related assisting occupations (313) are expected to have an employment growth rate that is significantly above the national average. It should be noted also that this group's share of total employment should be substantial as well (3.5 per cent).

. Another seemingly unlikely growth rate is that projected for clerical occupations in bookkeeping and account-recording (code 413), given what we know about the effects of computerization on many of the lower skilled jobs like teller/cashiers and statistical clerks. However, such a movement towards the greater use of computers will likely change only the composition and nature of the clerical work force and may, in fact, attract increasing numbers into this line of work. Indeed this group's share of total employment will be quite large (4.5 per cent). Other clerical and related occupations (code 419), also, will exhibit a high annual employment growth and share in the next few years (3.6 per cent). Workers included in this category are collectors, claim adjusters, hotel clerks, personnel clerks and general office clerks.

. The employment of service sales people (code 517) should be above the annual average of 2.7 per cent up to the year 1985. Such a group includes security brokers, real estate agents, advertising salesmen and others. The strong projected employment growth is no doubt reflective of the general trend towards a service-dominated economy, an economy which people have an increasing need of experts to deal with. Another aspect of this movement towards services is the high employment growth predicted for lodging and accommodation occupations.

. Occupational employment normally found in agriculture, fishing and trapping and forestry (71, 73, 75) is not expected to experience growth in the upcoming years.

. Mining, quarrying including oil and gas field occupations (code 77) and mineral ore treating (code 811) loosely comprise another broad occupational group which should experience well-above average annual growth in employment over the next three or four years. The growing emphasis on minerals along with, of course, the ever-present requirement for fuel oil will undoubtedly contribute to this strong performance.

. Stationary engine and utilities equipment operators (code 953) should figure prominently in future hirings as employment of this occupational group is expected to grow at an annual rate of 3.4 per cent. Certainly, the need to control the internal environment (heat, light, ventilation) of the increasing number of

construction projects has contributed substantially to this above-average growth performance.

. In spite of shortage problems found in a few cases, occupations found in manufacturing are not expected to grow dramatically in the medium term future. Among the occupations which are found mainly in manufacturing, only wood processing occupations, except pulp and papermaking (823), machining occupations in wood, clay, glass, and stone, and other materials (835, 837), and wood fabricating, assembling and repairing occupations (854) are projected to have employment growth rates that are higher than the national average. Many occupation groups in the manufacturing sector, which are expected to experience some form of shortage, are not among the fastest-growing employment groups identified here. This is not surprising, because ex ante demand cannot always be met. Unsatisfied demand would show up as job vacancies, rather than as an increase in employment.

. Jobs in the service sector, in the broadest sense of the term, will have average growth rates that are either better than or close to the national average.

In sum, although the employment outlook for a number of occupational categories appears fairly gloomy, there is, according to our employment projections, hope for others. For instance, hirings in positions related to management and administration will continue to grow strongly while maintaining a fairly large

proportion of total employment. Next, we discovered some grounds for optimism for those trained in physical and life sciences, architecture and engineering, and mathematics, statistics and systems analysis, although their share of total employment is still not expected to be large. We also noted that past exoduses and an aging population have combined to push up the employment of nurses and therapists.

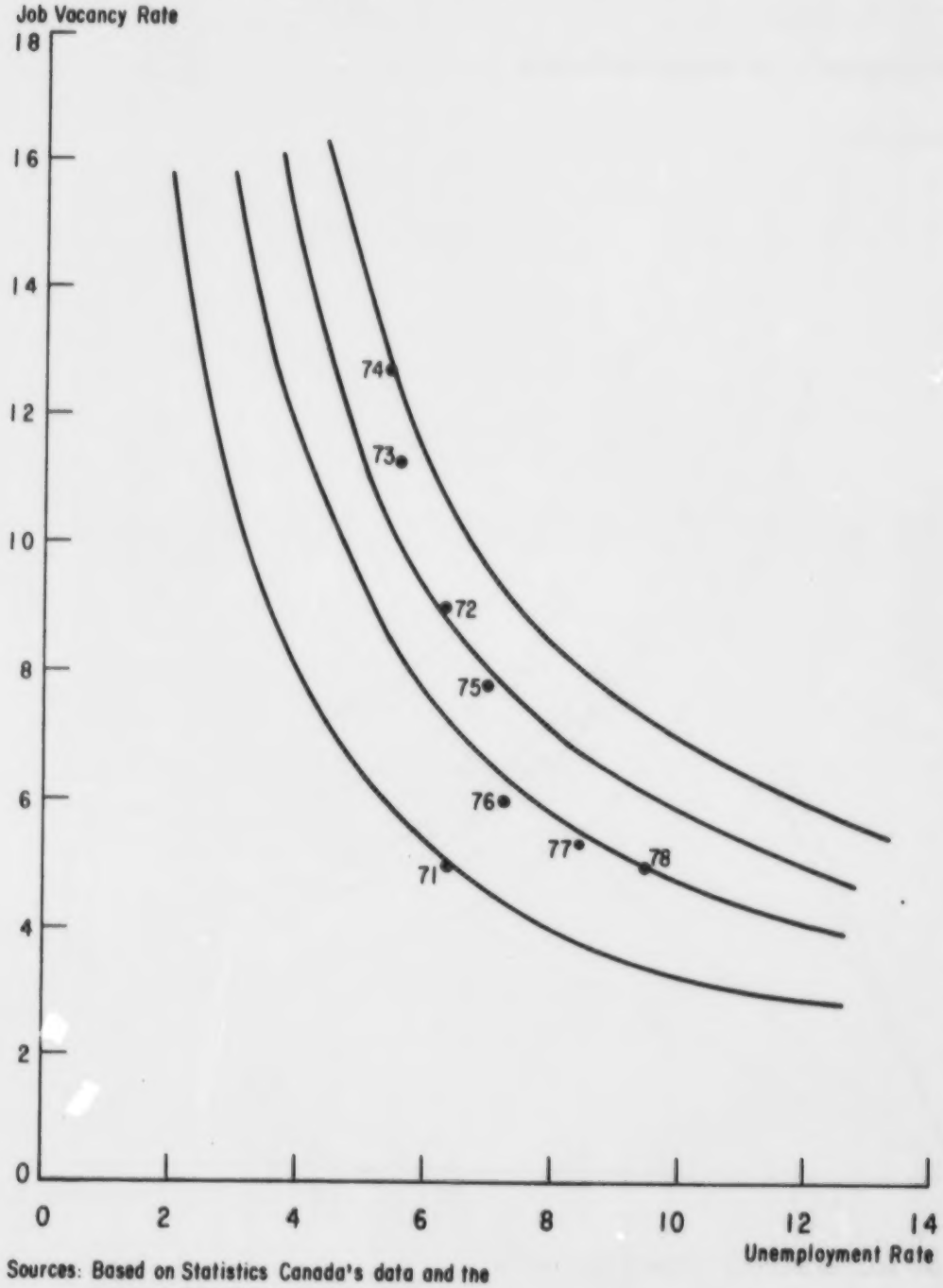
There were other occupational areas showing promise. For one, employment of various clerks was projected to grow strongly, despite the spread of computerization. Secondly, we are expecting a number of service-related occupations, namely sales and lodging, should figure prominently in the employment rolls at least until the mid-80s.

Before concluding this section, it should be re-emphasized that estimates of employment growth and shares give us a suggestion of job availability but do not necessarily indicate shortage problems. A simple correlation analysis of employment growth versus vacancy growth would verify that there is little connection between the two variables. Therefore, the use of one as a proxy for the other would be misleading. If the issue is skill shortages, then vacancy information would be the more relevant indicator for policy formulation. On the other hand, employment information provides a description of where people will be employed, and is of some interest to existing and potential members of the labour force and other decision makers. Employment

configuration is largely dictated by the composition of industrial output and the state of technology. Although government policies, such as measures to stimulate capital formation, can have some impact in these areas, the process is very slow. Therefore, employment configuration as a source of information for policy formulation is of relevance only in the medium to long run context.

Figure 2

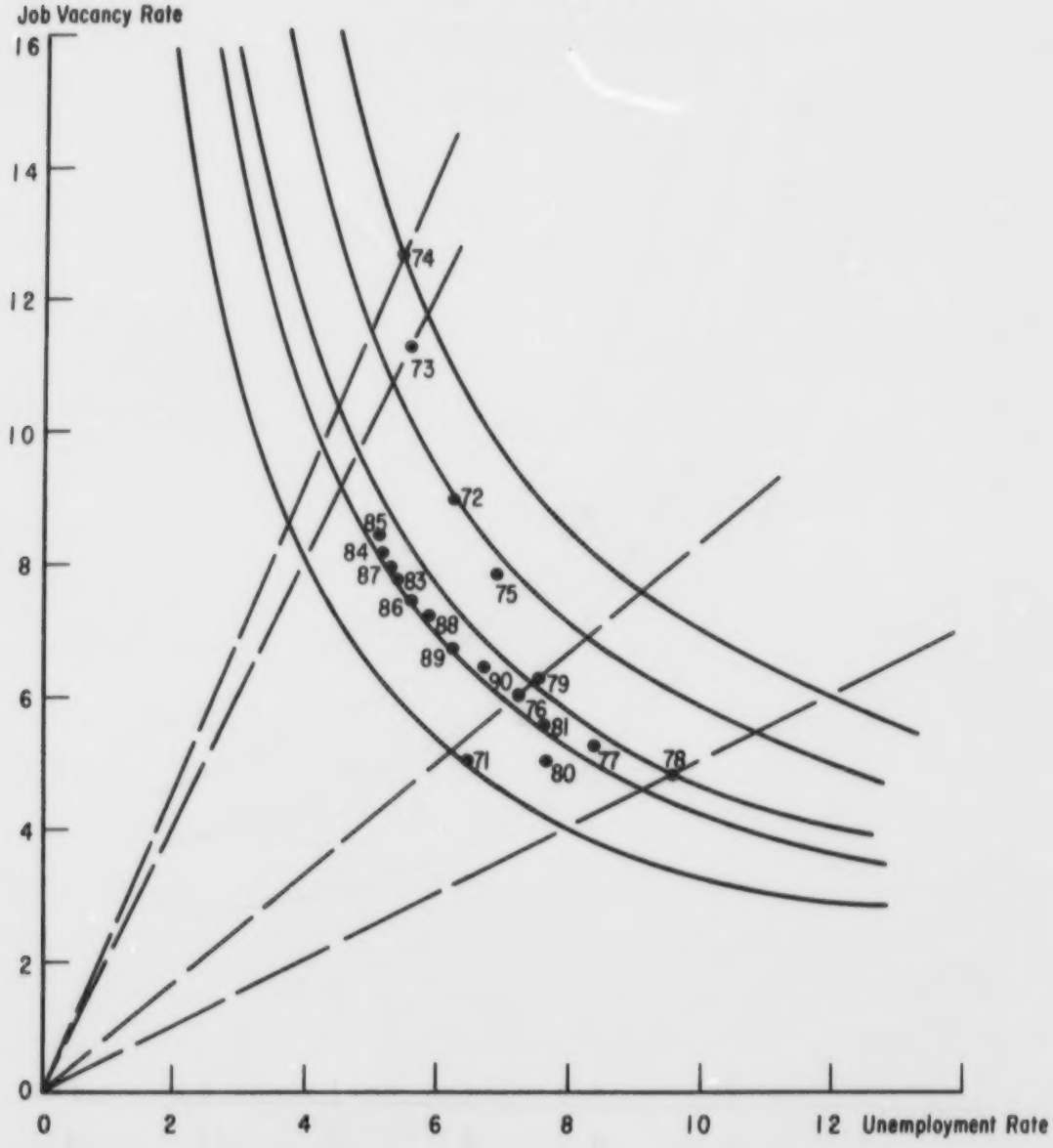
The Unemployment — Job Vacancy Relationship



Sources: Based on Statistics Canada's data and the Economic Council of Canada's estimates.

Figure 3

The Unemployment – Job Vacancy Relationship



Sources: Based on Statistics Canada's data and the Economic Council of Canada's estimates.

Table 1

Comparison of the Results of the Human Resources Survey and the Job Vacancy Survey by Selected "Blue Collar" Occupations, Canada

	CCDO	Share of HRS Total Shortage Situations (1977-1979)	Share of JVS Total Vacancies (1978)	Average Annual JVS Vacancy Growth[1] (1971 to 1978)
			(Per cent)	
Fabricating, repair				
Machinery mechanics	8584	6.5	2.3	17.8
Motor vehicle mechanics	8581	3.7	1.9	-1.5
Equipment electricians	8533	2.1	2.7	8.2
Sewing machine operators	8563	1.9	1.8	-8.0
Machining				
Machinists	8313	3.9	1.6	28.7
Welders	8335	2.6	1.3	7.2
Tool and die makers	8311	2.3	1.0	84.3
Machine tool operators	8315	1.1	0.7	36.1
Service				
Chefs	6121	2.2	1.1	4.3
Food servers	6125	1.2	1.9	---
Janitors	6191	1.1	1.2	1.5
Food service supervisors	6120	0.6	0.4	1.8
Construction				
Excavators and graders	8711	1.2	0.2	-2.6
Pipefitters and plumbers	8791	0.9	0.5	---
Carpenters	8781	0.8	0.6	-6.8
Processing				
Meat cutters	8215	1.0	0.3	---
Bakers	8213	0.5	0.2	-5.7
Sawyers	8231	0.5	--	-5.4
Moulders	8137	0.3	0.2	13.9
All occupations		100.0	100.0	2.4

1 Calculated simply as $[(V_{78i} - V_{71i}) \div V_{71i} \times 100] \div 7$ where V_{ti} is the vacancies in year t and occupation i and 7 represents the number of years from 1971 to 1978.

Source: Based on Betcherman (1982) and unpublished Job Vacancy Survey data.

Table 2

Comparison of the Results of the Human Resources Survey and the Job Vacancy Survey by Selected "White Collar" Occupations, Canada

	CCDO	Share of HRS Total Shortage Situations (1977-1979)	Share of JVS Total Vacancies (1978)	Average Annual JVS Vacancy Growth[1] (1971 to 1978)
		(Per cent)		
Sciences and engineering				
Industrial engineers	2145	1.3	0.7	26.0
Mechanical engineers	2147	1.1	0.5	19.0
Electrical engineers	2144	0.9	0.5	5.2
Civil engineers	2143	0.6	0.3	5.2
Systems analysts, programmers	2183	1.8	1.7	12.2
Engineering technologists	2165	1.8	2.3	67.2
Draughters	2163	1.4	1.1	20.3
Managerial				
Accountants	1171	2.0	1.9	25.7
Product managers	1143	0.6	0.3	21.3
Financial managers	1135	0.5	0.7	25.0
Sales managers	1137	0.4	0.4	25.7
Clerical				
Secretaries	4111	1.7	4.1	5.0
Accounting clerks	4131	1.5	1.7	7.2
Clerk-typists	4113	1.4	2.1	0.1
EDP equipment operators	4143	0.9	0.7	14.5
Sales				
Commodity sales supervisors	5130	2.1	0.4	-6.0
Commodity salespersons	5135	1.4	0.9	-7.3
Sales clerks	5137	1.0	2.6	--
Technical salespersons	5131	0.9	0.4	216.4
All occupations		100.0	100.0	2.4

1 See Table 1.

Source: See Table 1.

Table 3

Projected High[1] Vacancy Growth and Share
Occupational Areas, Canada, 1981-85

Occupational Area	CCDO	Vacancy Growth Rate[2] (Per cent)	Vacancy Share[3]
"Other" engineering and architectural	216	14.1	3.7
Material recording, scheduling, distributing	415	13.4	1.4
Protective service	611	16.1	1.7
Food and beverage preparation and related	612	15.1	7.1
"Other" service	619	14.6	2.0
Metal processing	813/814	26.3	1.4
Metal machining	831	16.0	3.1
Metal shaping and forming	833	20.0	3.5
Fabricating, assembling: metal products, n.e.c.	851/852	14.8	1.7
Fabricating, assembling, installing and repairing: electrical and electronic products	853	15.6	1.6
Mechanics and repairers, n.e.c.	858	13.5	6.0
"Other" construction trades	878/879	13.6	4.6
Motor transport operating	917	14.2	2.4
Material handling and related, n.e.c.	93	18.5	1.5
Average		12.7	1.3[4]

1 For growth, greater than Canadian average of 12.7%; for share, greater than "average" 1.3%.

2 Average annual rate of growth of vacancies over the 1981-85 period.

3 Vacancies as a percentage of total vacancies, averaged over 1981-85 year period.

4 The "average" share is really just 1 divided by the number of occupations (= 1/75 = 1.3%).

Source: Statistics Canada data and Economic Council of Canada's own calculations.

Table 4

Projected High[1] Vacancy Growth and Low[3] Vacancy Share
Occupational Areas, Canada, 1981-85

Occupational Area	CCDO	Vacancy Growth Rate[2]	Vacancy Share[4]
		(Per cent)	
Office machine and EDP equipment operating	414	13.2	1.1
Lodging and other accommodation	613	13.4	0.7
Clay, glass, stone processing, forming	815	14.9	0.2
Wood machining	835	22.8	0.2
Clay, glass, stone machining	837	14.6	0.1
"Other" machinery and related	839	13.6	0.4
Fabricating, assembling, repairing: rubber, plastic products	857	21.2	0.7
"Other" fabricating, assembling repairing	859	17.3	0.8
Water transport operating	915	14.4	0.2
"Other" craft and equipment operating, n.e.c.	959	13.2	0.1
Average		12.7	1.3[5]

1 Vacancies that will grow at a rate that is greater than the National average of 12.7 per cent.

2 See footnote 2 of table 3.

3 Share of total vacancies will average less than "average" share of 1.3% over 1981-85 period.

4 See footnote 3 of table 3.

5 See footnote 4 of table 3.

Source: See table 3.

Table 5

Projected High[1] Vacancy Share and Low[3] Vacancy Growth Occupational Areas, Canada, 1981-85

Occupational Area	CCDO	Vacancy Share[2] (Per cent)	Vacancy Growth Rate[4]
"Other" manager and administrator	113/114	1.4	8.9
Occupations related to management/ administration	117	3.6	10.2
Architects and engineers	214/215	3.2	12.7
Nursing, therapy and related	313	3.8	12.5
Stenographic and typing	411	5.8	9.5
Bookeeping, account-recording	413	3.9	10.6
Reception, information, mail	417	1.7	9.8
"Other" clerical and related	419	3.4	11.4
Sales: commodities	513/514	4.5	7.4
Mining and quarrying including oil and gas	77	1.5	12.4
Fabricating, assembling: textile fur and leather products	855/856	2.0	10.2
Average		1.3[5]	12.7

1 Share of total vacancies greater than "average" of 1.3 per cent.

2 See footnote 3 of Table 3.

3 Growth of total vacancies less than average of 12.7% over 1981-85 period.

4 See footnote 2 of Table 3.

5 See footnote 4 of Table 3.

Source: See Table 3.

Table 6

Projected Employment Growth and Share, by Selected High Employment Growth Occupation, Canada, 1981-1985

Occupational Area	CCDO	Average Annual Growth Rate (Per cent)	Average Annual Share
Related to management and administration	117	2.8	2.3
Physical Sciences	211	3.2	0.4
Life sciences	213	2.8	0.2
Architects and engineers	214	3.3	1.0
"Other occupations in architecture and engineering	216	3.1	0.9
Mathematics, statistics, systems analysis, and related	218	2.9	0.3
Nursing, therapy and related assisting occupations	313	3.1	3.5
Bookkeeping and related account-recording	413	2.8	4.5
"Other clerical and related	419	3.6	3.6
Sales occupations: services	517	3.6	1.3
Lodging and accommodation	613	2.9	0.5
Mining and quarrying including ore and gas field occupations	77	6.0	0.7
Mineral ore treating	811	5.0	0.1
Wood processing	823	3.4	0.5
Wood machining	835	2.9	0.1
Wood products fabricating, assembling and repairing	854	2.8	0.3
Stationary engine and utilities equipment operating	953	3.4	0.6

Source: ECC's own calculations.

Notes

Chapter IV

1 Results are reported at the 3-digit level to avoid small-sampling problems created by the use of a 4-digit disaggregation.

2 See Leckie (1981) and Library of Parliament (1981).

3 See Betcherman (1982).

4 In general, the 5 per cent level of significance is used for all of the tests. In a few cases, where the equations pass the "F" tests and some of the estimated coefficients have the right signs with "t" values greater than one but statistically insignificant at the 5 per cent level, the equations are accepted without further modification.

5 Typically, cross-section analyses incorporate a large number of regressors in the specified equations to account for the different attributes of the individual units which cannot be explained by the general theory implied in the other regressors.

6 When MODCOFOR is used to project all of the four-digit CCDO occupations, the projected occupational employment figures are, by definition, summed to the industry employment figures projected by CANDIDE 2.0. When the 211 projected occupational employment series by CSSM are used in conjunction with the remaining projected figures from MODCOFOR, the occupational totals do not add up to the industry employment totals. However, the discrepancies are relatively small, and therefore no post-projection adjustments have been used to revise the projected figures.

7 See Glejser (1969) for the exact technical details.

8 See Maddala (1977) and Kennedy (1979).

9 The projected figures presented in this study are the ones from the O.L.S. equations.

10 This is generally in agreement with the finding of Reid and Meltz (1979) which is based on different sample periods, data sources, and a slightly different specification and functional form.

11 This is confirmed by the estimated coefficient of the unemployment-job vacancy equation.

12 The vacancy by occupation equations were also estimated by both methods. The lagged values of the regressors have been used as instruments. Also the distribution free technique, namely the grouping method (see Kendall 1980), has been used to check the appropriateness of the lagged regressor as instruments. The

O.L.S. equations are the ones used for the projection exercise presented in this study.

13 See Economic Council of Canada (1981), Chapter 2, pp. 33-61.

14 At the time of the projection run, this was the most recent scenario available.

15 All of the industrial employment figures are from CANDIDE 2.0's data bank and its base case solution of September 1981.

16 It is generally based on the argument that these new members of the labour force are generally less well equipped to meet the demand of the jobs in the labour market than the main-stream labour force.

17 See Economic Council of Canada (1976).

18 This is, of course, an arbitrary line. Since it is only used as a bench mark for comparison, its arbitrariness does not affect the conclusion.

19 As the reader will notice, no formal sensitivity analysis has been presented on both vacancy and employment projection for this study. However, three separate projections, based on three different macro-economic scenarios -- relatively high growth, "middle of the road", and relatively low growth -- were run. The results presented in this study are based on the second economic scenario. The projected figures are, of course, different for all three of the projections. However, compared to the projected vacancy figures, the differences among the projected occupational employment figures are relatively small. The differences among the projected vacancy figures, on the other hand, are more sensitive to changes in the economic climate.

20 As of to-day, there exists neither a methodology nor an operationally quantitative model that can acceptably handle the labour force by occupation projection exercise. The estimation of labour supply by occupation is not only hampered by the lack of useful time series, it is also not suitable for the fixed coefficient model. First, while the change in industrial employment over time is a horizontal movement which reflects the structural change of the economy, the change in labour force by age-sex and occupation is a matter of the aging process, entry and attrition. The latter does not have the same economic meaning as the change of industrial employment has. Secondly, the aging process of the labour force entails a simultaneous change in the proportion of a certain age-sex group in a given occupation. This change can only be offset by a very specific exit-entry pattern which is an unlikely event. In Freeman (1980), Freeman argues that the industrial employment change term on the right-hand side of his occupational employment change identity can account for about 50 per cent of the variation of the occupational employment.

The other two right-hand side terms, namely the change in the technological coefficients, and the interaction term (the product of industrial employment change and technological coefficients), account for the remaining variation. In the labour force by occupation case, the aging process means that the interaction term and the change of the technological coefficient term must carry heavier weights than they are in the employment case. This automatically rules out the feasibility of using the fixed coefficient model for projecting labour force by occupation.

Chapter V Concluding Remarks

The deteriorating performance of the Canadian labour market during the 70s, as manifested in increasing rates of unemployment, has been well documented. Different schools of thought have advanced a number of hypotheses regarding the greater degree of structural and frictional unemployment for that period. Our analysis of the "UV" relationship generally corroborates the finding of a greater mismatching of labour demand and supply in the period of 1971 to 1975. However, our research also indicates that this maladjustment has been reduced somewhat since 1975, although the improvement was not large enough to bring us back to 1971 conditions. In this sense, the "UV" curve has shifted outward during the 1970s. For the second half of the decade, a substantial portion of the unemployment for the period can be classified as structural and frictional unemployment. This is verified by the distances of the "UV" curves from the origin in every year since 1975 as depicted in Figure 2. In the same graph, we also saw that a large portion of the unemployment was due to inadequate demand. This is confirmed by the locations of all of the points for the 1976-1980 period: they are far from the lines representing the tight labour market years of 1973 and 1974. Therefore, relatively speaking, the labour market in the second half of the '70s was much looser than it was during the first half of the decade.

The shortage problem in the late 1970s was no worse than that during the first half of the decade. One cannot help but wonder, then, why the shortage issue has received as much publicity as it did while being practically ignored in the early '70s. In a society that is free as well as imperfect, job vacancies and unemployment have always existed, and will continue to exist, together. There is no reason to believe that a vacant position for, say, an electrical engineer in the mid-sixties was of less importance than one today. A shortfall in the past was accepted simply as a manifestation of cyclical variations, while the recent hue and cry about shortages have somehow created the impression that the problem is quite different today.

This is not necessarily the case. The danger of the present "bandwagon" type of approach, of course, is that a minor shortage can be turned into a surplus by the sheer volume of the outcry. This is particularly true of occupations specific to the manufacturing sector. If manufacturing output is not expected to grow strongly in the 1980s, then the manpower requirements of this sector should not be high. On the other hand, there has been great media attention directed towards the need for particular "blue collar" skills such as millwright and tool and die making. If policy makers prescribe manpower measures purely on a "squeaky wheel" basis, then we can expect this relatively small labour market to be flooded with excess supplies of workers in the years to come. The limited number of blue collar vacancies should not, of course, be left unfilled; however, the eradiction of these

vacancies should not occur at the cost of creating a gross and artificial misallocation of human resources.

In the absence of any comprehensive forward-looking information, however, decision makers - including potential members of the labour force, educators, human resources managers of private enterprises, and government policy makers - are likely to react to current market conditions only. This tends to augment the shortage-surplus problem throughout the "goodtime-badtime" cycle. This is too important an aspect of the Canadian economy to be left as it is. It is our contention that the government can improve the present situation by providing the public with regular, comprehensive projected information on occupational demand.[1] This requires a vast improvement in the present Canadian occupational data base including reviving now defunct national employment and vacancy surveys, intensive and continuous efforts to improve occupational demand modelling and projection techniques, and efficient means of disseminating the projected information.[2]

At the present time, however, Canada does not have the proper facilities to meet these urgent requirements; nor can it afford to wait for the establishment of a solid occupational data base, a development which could take many years. In the meantime, then, it must authorize its own agencies, as well as private organizations, to attempt, at least, to undertake occupational demand projections with existing data and knowledge. And, like

most forecasts, the projected figures should be continuously revised, updated, and disseminated to the public, who should not be discouraged from using this information as an aid to decision-making. Its indefinitive nature, however, should be clearly spelled out.[3]

On the other hand, macro econometric models are presently in their third generation. These models are based on relatively solid data bases and established economic theories. Yet, policy makers have been rather skeptical about the forecasts produced by any of the Canadian econometric models. Because of the difficult nature of the art, however, this situation will likely remain unchanged for many years to come. Moreover, in comparison to existing Canadian macro econometric models, as we saw, occupational demand models are still in their infancy stage. It will take many years of continuous effort on the part of researchers and data collection agencies till the latter reach the supposed degree of maturity the former have attained.

Still, the inability of econometric models to produce accurate ex ante forecasts has been indirectly responsible for creating a lot of misgivings among laymen as well as analysts. Some believe that they would be better off to ignore all projected figures and gather their own information by going directly to a micro instrument, such as a special survey. As Leckie (1981) has shown, however, these surveys, even when they are well designed and executed, ordinarily can yield only two types of limited

information. First, although surveys may tell us something about the current manpower situation, they usually do so only in a particular arena of interest; for example, they may inform us that a chemical plant in Sudbury, Ontario, has five vacant positions for chemical engineers. Secondly, surveys can provide estimates of what only the immediate future will hold. As has been mentioned above, however, current information alone cannot help the country alleviate its labour market imbalances which are generally symptomatic of a longer-term malaise. Furthermore, employers' responses to the questionnaires are often tentative and highly subjective (based, as they are, on an uncertain and volatile future) while the expense of conducting and documenting a comprehensive survey effort is large. Taking all these factors into consideration, then, the contribution to decision making that forecasting models make -- albeit with projections that may not be 100 per cent accurate -- should be beyond question.

Notes

Chapter V

1 However, we do laud present efforts to introduce the occupational question on the 1981 mid-decade census.

2 COFOR released its COFOR 81 forecast in 1975, and its COFOR 85 forecast in 1981. Aside from the fact that very few obtained copies of the detailed projections, the information was made available to the general public only in the form of a few sketchy newspaper reports. In short, both the data dissemination and the frequency of releasing forecasts left a lot to be desired.

3 In fact, Employment and Immigration Canada has recently made efforts in this area by the introduction of its Canadian Operational Projection System which now allows the users to introduce their own assumptions into the model and observe the ramifications on occupational supply and demand.

APPENDIX A
LIST OF OCCUPATIONS AND THE MODELS USED TO PROJECT THEM

OCCUPATION CODE	MODEL* USED	OCCUPATION DESCRIPTION
111	N.A.	Officials and Administrators, Government
1113	MODCOFOR	Government Administrators
1115	MODCOFOR	Postmasters
1116	MODCOFOR	Inspectors and Regulatory Officers, Government
1119	MODCOFOR	Officials and Administrators Unique to Government, n.e.c.
113	N.A.	Other Managers and Administrators
1130	CSSM	General Managers and Other Senior Officials
1131	CSSM	Management Occupations, Natural Sciences and Engineering
1132	CSSM	Management Occupations, Social Sciences and Related Fields
1133	CSSM	Administrators in Teaching and Related Fields
1134	CSSM	Administrators in Medicine and Health
1135	MODCOFOR	Financial Management Occupations
1136	CSSM	Personnel and Industrial Relations Management Occupations
1137	CSSM	Sales and Advertising Management Occupations
1141	CSSM	Purchasing Management Occupations
1142	CSSM	Services Management Occupations
1143	MODCOFOR	Production Management Occupations

* Note: MODCOFOR denotes modified COFOR. CSSM is the MNEMONIC for cross-section-stochastic model. "N.A." refers to "Not Applicable".

1145	CSSM	Management Occupations, Construction Operations
1147	MODCOFOR	Management Occupations, Transport and Communications Operations
115	CSSM	Other Managers and Administrators, n.e.c.
117	N.A.	Occupations Related Management and Administration
1171	CSSM	Accountants, Auditors and Other Financial Officers
1174	CSSM	Personnel and Related Officers
1175	CSSM	Purchasing Officers and Buyers, Except Wholesale and Retail Trade
1176	CSSM	Inspectors and Regulatory Officers, Non-Government
1179	CSSM	Occupations Related to Management and Administration n.e.c.
211	N.A.	Occupations in Physical Sciences
2111	CSSM	Chemists
2112	CSSM	Geologists
2113	CSSM	Physicists
2114	MODCOFOR	Meteorologists
2117	CSSM	Physical Sciences Technologists and Technicians
2119	CSSM	Occupations in Physical Sciences n.e.c.
213	N.A.	Occupations in Life Sciences
2131	MODCOFOR	Agriculturists and Related Scientists

2133	CSSM	Biologists and Related Scientists
2135	CSSM	Life Sciences Technologists and Technicians
2139	CSSM	Occupations in Life Sciences, n.e.c.
214	N.A.	Architects and Engineers
2141	CSSM	Architects
2142	MODCOFOR	Chemical Engineers
2143	CSSM	Civil Engineers
2144	CSSM	Electrical Engineers
2145	CSSM	Industrial Engineers
2147	CSSM	Mechanical Engineers
2151	MODCOFOR	Metallurgical Engineers
2153	CSSM	Mining Engineers
2154	MODCOFOR	Petroleum Engineers
2155	MODCOFOR	Aeronautical Engineers
2159	CSSM	Architects and Engineers, n.e.c.
216	N.A.	Other Occupations in Architecture and Engineering
2160	CSSM	Supervisors: Other Occupations in Architecture and Engineering
2161	CSSM	Surveyors
2163	CSSM	Draughtsmen
2165	CSSM	Architectural and Engineering Technologists and Technicians
2169	CSSM	Other Occupations in Architecture and Engineering n.e.c.

218	N.A.	Occupations in Mathematics, Statistics, Systems Analysis and Related Fields
2181	CSSM	Mathematics, Statisticians and Actuaries
2183	CSSM	Systems Analysts, Computer Programmers and Related Occupations
2189	CSSM	Occupations in Mathematics, Statistics, Systems Analysis and Related Fields, n.e.c.
231	N.A.	Occupations in Social Sciences
2311	CSSM	Economists
2313	CSSM	Sociologists, Anthropologists and Related Social Scientists
2315	CSSM	Psychologists
2319	CSSM	Occupations in Social Sciences, n.e.c.
233	N.A.	Occupations in Social Work and Related Fields
2331	CSSM	Social Workers
2333	CSSM	Occupations in Welfare and Community Services
2339	CSSM	Occupations in Social Work and Related Fields n.e.c.
234	N.A.	Occupations in Law and Jurisprudence
2341	MODCOFOR	Judges and Magistrates
2343	CSSM	Lawyers and Notaries
2349	CSSM	Occupations in Law and Jurisprudence, n.e.c.
235	N.A.	Occupations in Library, Museum and Archival Sciences

2350	CSSM	Supervisors: Occupations in Library, Museum and Archival Sciences
2351	CSSM	Librarians and Archivists
2353	CSSM	Technicians in Library, Museum and Archival Sciences
2359	CSSM	Occupations in Library, Museum and Archival Sciences n.e.c.
239	N.A.	Other Occupations in Social Sciences and Related Fields
2391	CSSM	Educational and Vocational Counsellors
2399	CSSM	Other Occupations in Social Sciences and Related Fields n.e.c.
25	N.A.	Occupations in Religion
2511	MODCOFOR	Minister of Religion
2513	MODCOFOR	Nuns and Brothers (W),n.o.r.
2519	MODCOFOR	Occupations in Religion, n.e.c.
271	N.A.	University Teaching and Related Occupations
2711	MODCOFOR	University Teachers
2719	MODCOFOR	University Teaching and Related Occupations, n.e.c.
273	N.A.	Elementary and Secondary School Teaching and Related Occupations
2731	MODCOFOR	Elementary and Kindergarten Teachers
2733	MODCOFOR	Secondary School Teachers
2739	MODCOFOR	Elementary and Secondary School Teaching and Related Occupations, n.e.c.

279	N.A.	Other Teaching and Related Occupations
2791	CSSM	Community College and Vocational School Teachers
2792	CSSM	Fine Arts School Teachers
2793	MODCOFOR	Post-Secondary School Teachers, n.e.c.
2795	MODCOFOR	Teachers of Exceptional Students, n.e.c.
2797	CSSM	Instructors and Training Officers, n.e.c.
2799	CSSM	Other Teaching and Related Occupations, n.e.c.
311	N.A.	Health Diagnosing and Treating Occupations
3111	CSSM	Physicians and Surgeons
3113	CSSM	Dentists
3115	MODCOFOR	Veterinarians
3117	MODCOFOR	Osteopaths and Chiropractors
3119	CSSM	Health Diagnosing and Treating Occupations, n.e.c.
313	N.A.	Nursing, Therapy and Related Assisting Occupations
3130	CSSM	Supervisors: Nursing Occupations
3131	CSSM	Nurses, Graduate, except Supervisors
3133	MODCOFOR	Nurse-in-Training
3134	MODCOFOR	Nursing Assistants
3135	CSSM	Nursing Aides and Orderlies
3137	CSSM	Physiotherapists, Occupational and Other Therapists

3139	CSSM	Nursing, Therapy and Related Assisting Occupations, n.e.c.
315	N.A.	Other Occupations in Medicine and Health
3151	CSSM	Pharmacists
3152	CSSM	Dietitians and Nutritionists
3153	CSSM	Optometrists
3154	CSSM	Dispensing Opticians
3155	CSSM	Radiological Technologists and Technicians
3156	CSSM	Medical Laboratory Technologists and Technicians
3157	CSSM	Dental Hygienists, Assistants and Technicians
3159	CSSM	Other Occupations in Medicine and Health, n.e.c.
331	N.A.	Occupations in Fine and Commercial Art, Photography and Related Fields
3311	CSSM	Painters, Sculptors and Related Artists
3313	CSSM	Product and Interior Designers
3314	CSSM	Advertising and Illustrating Artists
3315	CSSM	Photographers and Cameramen
3319	CSSM	Occupations in Fine and Commercial Art, Photography and Related Fields, n.e.c.
333	N.A.	Occupations in Performing and Audio-Visual Arts
3330	CSSM	Producers and Directors, Performing and Audio-Visual Arts

3332	CSSM	Musicians
3333	MODCOFOR	Dancers and Choreographers
3335	MODCOFOR	Actors
3337	MODCOFOR	Radio and Television Announcers
3339	CSSM	Occupations in Performing and Audio-Visual Arts, n.e.c.
335	N.A.	Occupations in Writing
3352	CSSM	Writers and Editors
3355	CSSM	Translators and Interpreters
3359	CSSM	Occupations in Writing, n.e.c.
337	N.A.	Occupations in Sport and Recreation
3370	CSSM	Coaches, Trainers, Instructors and Manager, Sport and Recreation
3371	MODCOFOR	Referees and Related Officials
3373	MODCOFOR	Athletes
3375	CSSM	Attendants, Sports and Recreation
3379	CSSM	Occupations in Sport and Recreation, n.e.c.
411	N.A.	Stenographic and Typing Occupations
4110	CSSM	Supervisors: Stenographic and Typing Occupations
4111	CSSM	Secretaries and Stenographers
4113	CSSM	Typists and Clerk-Typists
413	N.A.	Bookkeeping, Account-recording and Related Occupations

4130	CSSM	Supervisors: Bookkeeping, Account-recording and Related Occupations
4131	CSSM	Bookkeepers and Accounting Clerks
4133	CSSM	Tellers and Cashiers
4135	MODCOFOR	Insurance, Bank and Other Finance Clerks
4137	CSSM	Statistical Clerks
4139	CSSM	Bookkeeping, Account-recording and Related Occupations, n.e.c.
414	N. A.	Office Machine and Electronic Data-processing Equipment Operators
4140	CSSM	Supervisors: Office Machine and Electronic Data-processing Equipment Operators
4141	CSSM	Office Machine Operators
4143	CSSM	Electronic Data-processing Equipment Operators
415	N.A.	Material-recording, Scheduling and Distributing Occupations
4150	CCSM	Supervisors: Material-recording, Scheduling and Distributing Occupations
4151	CSSM	Production Clerks
4153	CSSM	Shipping and Receiving Clerks
4155	CSSM	Stock Clerks and Related Occupations
4157	MODCOFOR	Weighers
4159	CSSM	Material-recording, Scheduling and Distributing Occupations, n.e.c.
416	N.A.	Library, File and Correspondence Clerks and Related Occupations

4160	CSSM	Supervisors: Library, File and Correspondence Clerks and Related Occupations
4161	CSSM	Library and File Clerks
4169	CSSM	Library, File and Correspondence Clerks and Related Occupations, n.e.c.
417	N.A.	Reception, Information, Mail and Message Distribution Occupations
4170	MODCOFOR	Supervisors: Reception, Information, Mail and Message Distribution Occupations
4171	CSSM	Receptionists and Information Clerks
4172	MODCOFOR	Mail Carriers
4173	MODCOFOR	Mail and Postal Clerks
4175	CSSM	Telephone Operators
4177	CSSM	Messengers
4179	CSSM	Reception, Information, Mail and Message Distribution Occupations, n.e.c.
419	N.A.	Other Clerical and Related Occupations
4190	CSSM	Supervisors: Other Clerical and Related Occupations, n.e.c.
4191	CSSM	Collectors
4192	CSSM	Adusters, Claim
4193	MODCOFOR	Travel Clerks, Ticket, Station and Freight Agents
4194	MODCOFOR	Hotel Clerks
4195	CSSM	Personnel Clerks
4197	CSSM	General Office Clerks

4199	CSSM	Other Clerical and Related Occupations, n.e.c.
513	N.A.	Sales Occupations, Commodities
5130	CSSM	Supervisors: Sales Occupations, Commodities
5131	CSSM	Technical Salesmen and Related Advisers
5133	MODCOFOR	Commercial Travellers
5135	CSSM	Salesmen and Salespersons, Commodities, n.e.c.
5137	CSSM	Sales Clerks, Commodities
5141	CSSM	Street Vendors and Door-to-Door Salesmen
5143	MODCOFOR	Newsboys
5145	CSSM	Service Station Attendants
5149	CSSM	Sales Occupations: Commodities, n.e.c.
517	N.A.	Sales Occupations, Services
5170	MODCOFOR	Supervisors: Sales Occupations, Services
5171	MODCOFOR	Insurance Salesmen Agents
5172	MODCOFOR	Real Estate Salesmen
5173	MODCOFOR	Salesmen and Traders, Securities
5174	MODCOFOR	Advertising Salesmen
5177	MODCOFOR	Business Services Salesmen
5179	CSSM	Sales Occupations: Services, n.e.c.
519	N.A.	Other Sales Occupations
5190	CSSM	Supervisors: Other Sales Occupations
5191	MODCOFOR	Buyers, Wholesale and Retail Trade

5193	MODCOFOR	Driver-Salesmen
5199	CSSM	Other Sales Occupations, n.e.c.
611	N.A.	Protective Service Occupations
6111	MODCOFOR	Fire-fighting Occupations
6112	MODCOFOR	Policemen and Detectives, Government
6113	CSSM	Policemen and Investigators, Private
6115	CSSM	Guards and Watchmen
6116	N.A.	Commissioned Officers, Armed Forces
6117	N.A.	Other Ranks, Armed Forces
6119	CSSM	Protective Service Occupations, n.e.c.
612	N.A.	Food and Beverage Preparation and Related Service Occupations
6120	CSSM	Supervisors: Food and Beverage Preparation and Related Service Occupations
6121	CSSM	Chefs and Cooks
6123	CSSM	Bartenders
6125	CSSM	Waiters, Hostesses and Stewards, Food and Beverage
6129	CSSM	Food and Beverage Preparation and Related Service Occupations, n.e.c.
613	N.A.	Occupations in Lodging and Other Accommodation
6130	CSSM	Supervisors: Occupations and Lodging and Other Accommodation
6131	MODCOFOR	Managers: Hotel, Motel and Other Accomodation
6133	CSSM	Chambermaids and Housemen

6135	CSSM	Sleeping-car and Baggage Porters, and Bellmen
6139	CSSM	Occupations in Logging and Other Accommodation, n.e.c.
614	N.A.	Personal Service Occupations
6141	CSSM	Funeral Directors, Embalmers and Related Occupations
6143	CSSM	Barbers, Hairdressers and Related Occupations
6144	CSSM	Guides
6145	CSSM	Hostesses and Stewards, Except Food and Beverage
6147	CSSM	Babysitters
6149	CSSM	Personal Service Occupations, n.e.c.
616	N.A.	Apparel and Furnishings Service Occupations
6160	CSSM	Supervisors: Apparel and Furnishings Service Occupations
6162	CSSM	Laundering and Dry Cleaning Occupations
6165	CSSM	Pressing Occupations
6169	CSSM	Apparel and Furnishings Service Occupations, n.e.c.
619	N.A.	Other Service Occupations
6190	CSSM	Supervisors: Other Service Occupations
6191	CSSM	Janitors, Charworkers and Cleaners
6193	CSSM	Elevator Operating Occupations
6198	CSSM	Occupations in Labouring and Other Elemental Work, Services
6199	CSSM	Other Service Occupations, n.e.c.

711	MODCOFOR	Farmers
713	MODCOFOR	Farm Management Occupations
718	N.A.	Other Farming, Horticultural and Animal Husbandry Occupations
7180	MODCOFOR	Foremen: Other Farming, Horticultural and Animal Husbandry Occupations
7182	MODCOFOR	Farm Workers
7195	CSSM	Nursery and Related Workers
7197	MODCOFOR	Farm Machinery Operators and Custom Operators
7199	CSSM	Other Farming, Horticultural and Animal Husbandry Occupations, n.e.c.
73	N.A.	Fishing, Hunting, Trapping and Related Occupations
7311	MODCOFOR	Captains and Other Officers, Fishing Vessels
7313	MODCOFOR	Fishermen: Net, Trap and Line
7315	MODCOFOR	Hunting, Trapping and Related Occupations
7319	MODCOFOR	Fishing, Hunting, Trapping and Related Occupations, n.e.c.
75	N.A.	Forestry and Logging Operations
7510	MODCOFRR	Foremen: Forestry and Logging Occupations
7511	MODCOFOR	Forestry Conservation Occupations
7513	MODCOFOR	Timber Cutting and Related Occupations
7516	MODCOFOR	Log Inspecting, Grading, Scaling and Related Occupations

7517	MODCOFOR	Log Hoisting, Sorting, Moving and Related Occupations
7518	MODCOFOR	Occupations in Labouring and Other Elemental Work, Forestry and Logging
7519	MODCOFOR	Forestry and Logging Occupations, n.e.c.
77	N.A.	Mining and Quarrying, Including Oil and Gas Field Occupations
7710	MODCOFOR	Foremen: Mining and Quarrying, Including Oil and Gas Field Occupations
7711	MODCOFOR	Rotary Well-drilling and Related Occupations
7715	MODCOFOR	Blasting Occupations
7717	MODCOFOR	Mining and Quarrying: Cutting, Handling and Loading Occupations
7718	MODCOFOR	Occupations in Labouring and Other Elemental Work, Mining and Quarrying Including Oil and Gas Fields
7719	MODCOFOR	Mining and Quarrying, Including Oil and Gas Field Occupations, n.e.c.
811	N.A.	Mineral Ore Treating Occupations
8110	MODCOFOR	Foremen: Mineral Ore Treating Occupation
8111	MODCOFOR	Crushing and Grinding Occupations, Mineral Ores
8113	MODCOFOR	Mixing, Separation, Filtering and Related Occupations, Mineral Ores
8115	MODCOFOR	Melting and Roasting Occupations, Minera Ores
8116	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations, Mineral Ore Treating

8118	MODCOFOR	Occupations in Labouring and Other Elemental Work, Mineral Ore Treating
8119	MODCOFOR	Mineral Ore Treating Occupations, n.e.c.
813	N.A.	Metal Processing and Related Occupations
8130	MODCOFOR	Foremen: Metal Processing and Related Occupations
8131	MODCOFOR	Metal Smelting, Converting and Refining Furnacemen
8133	MODCOFOR	Metal Heat Treating Occupations
8135	MODCOFOR	Metal Rolling Occupations
8137	MODCOFOR	Moulding, Coremaking and Metal Casting Occupations
8141	MODCOFOR	Metal Extruding and Drawing Occupations
8143	MODCOFOR	Plating, Metal Spraying, and Related Occupations
8146	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations, Metal Processing
8148	MODCOFOR	Occupations in Labouring and Other Elemental Work, Metal Processing
8149	MODCOFOR	Metal Processing and Related Occupations, n.e.c.
815	N.A.	Clay, Glass and Stone Processing, Forming and Related Occupations
8150	MODCOFOR	Foremen: Clay, Glass and Stone Processing, Forming and Related Occupations
8151	MODCOFOR	Furnacemen And Kilnmen: Clay, Glass and Stone
8153	MODCOFOR	Separating, Grinding, Crushing and Misting Occupations: Clay, Glass and Stone

8155	MODCOFOR	Forming Occupations: Clay, Glass and Stone
8156	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations: Clay, Glass and Stone Processing and Forming
8158	MODCOFOR	Occupations in Labouring and Other Elemental Work: Clay, Glass and Stone Processing and Forming
8159	MODCOFOR	Clay, Glass and Stone Processing, Forming and Related Occupations n.e.c.
816	N.A.	Chemicals, Petroleum, Rubber, Plastics and Related Materials Processing Occupations
8160	MODCOFOR	Foremen: Chemicals, Petroleum, Rubber Plastics and Related Materials Processing Occupations
8161	MODCOFOR	Mining and Blending Occupations, Chemicals and Related Materials
8163	MODCOFOR	Filtering, Straining and Separating Occupations, Chemicals and Related Materials
8165	MODCOFOR	Distilling, Subliming and Carbonizing Occupations Chemicals and Related Materials
8167	MODCOFOR	Roasting, Cooking and Drying Occupations, Chemicals and Related Materials
8171	MODCOFOR	Crushing and Grinding Occupations, Chemicals and Related aterials
8173	MODCOFOR	Coating and Calendering Occupations, Chemicals and Related Materials
8176	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations: Chemicals, Petroleum, Rubber, Plastics, and Related Materials Processing

8178	MODCOFOR	Occupations in Labouring and Other Elemental Work: Chemicals, Petroleum, Rubber, Plastics and Related Materials Processing
8179	MODCOFOR	Chemicals, Petroleum, Rubber, Plastics and Related Materials Processing Occupations, n.e.c.
821	N.A.	Food, Beverage and Related Processing Occupations
8210	MODCOFOR	Foremen: Food, Beverage and Related Processing Occupations
8211	MODCOFOR	Flour and Grain Milling Occupations
8213	MODCOFOR	Baking Confectionery Making and Related Occupations
8215	MODCOFOR	Slaughtering and Meat Cutting, Canning, Curing and Packing Occupations
8217	MODCOFOR	Fish Canning, Curing and Packing Occupations
8221	MODCOFOR	Fruit and Vegetable Canning, Preserving and Packing Occupations
8223	MODCOFOR	Milk Processing Occupations
8225	MODCOFOR	Sugar Processing and Related Occupations
8226	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations: Food, Beverage and Related Occupations
8227	MODCOFOR	Beverage Processing Occupations
8228	MODCOFOR	Occupations in Labouring and Other Elemental Work: Food, Beverage and Related Processing
8229	MODCOFOR	Food, Beverage and Related Processing Occupations, n.e.c.
823	N.A.	Wood Processing, Occupations, Except Pulp and Papermaking

8230	MODCOFOR	Foremen: Wood Processing Occupations, Except Pulp and Papermaking
8231	MODCOFOR	Sawmill Sawyers and Related Occupations
8233	MODCOFOR	Plywood Making and Related Occupations
8235	MODCOFOR	Wood Treating Occupations
8236	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations: Wood Processing Except Pulp and Paper making
8238	MODCOFOR	Occupations in Labouring and Other Elemental Work: Wood Processing, Except Pulp and Papermaking
8239	MODCOFOR	Wood Processing Occupations, Except Pulp and Papermaking, n.e.c.
825	N.A.	Pulp and Papermaking and Related Occupations
8250	MODCOFOR	Foremen; Pulp and Papermaking and Related Occupations
8251	MODCOFOR	Cellulose Pulp Preparing Occupations
8253	MODCOFOR	Papermaking and Finishing Occupations
8256	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations, Pulp and Papermaking
8258	MODCOFOR	Occupations in Labouring and Other Elemental Work, Pulp and Papermaking
8259	MODCOFOR	Pulp and Papermaking and Related Occupations, n.e.c.
826	N.A.	Textile Processing Occupations
8260	MODCOFOR	Foremen: Textile Processing Occupations
8261	MODCOFOR	Textile Fibre Preparing Occupations

8263	MODCOFOR	Textile Spinning and Twisting Occupations
8265	MODCOFOR	Textile Winding and Reeling Occupations
8267	MODCOFOR	Textile Weaving Occupations
8271	MODCOFOR	Knitting Occupations
8273	MODCOFOR	Textile Bleaching and Dyeing Occupations
8275	MODCOFOR	Textile Finishing and Calendering Occupations
8276	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations: Textile Processing
8278	MODCOFOR	Occupations in Labouring and Other Elemental Work, Textile Processing
8279	MODCOFOR	Textile Processing Occupations, n.e.c.
829	N.A.	Other Processing Occupations
8290	MODCOFOR	Foremen: Other Processing Occupations
8293	MODCOFOR	Tobacco Processing Occupations
8295	MODCOFOR	Hide and Pelt Processing Occupations
8296	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations, Processing n.e.c.
8298	MODCOFOR	Occupations in Labouring and Other Elemental Work, Other Processing
8299	CSSM	Other Processing Occupations, n.e.c.
831	N.A.	Metal Machining Occupations
8310	MODCOFOR	Foremen: Metal Machining Occupations
8311	MODCOFOR	Tool and Die Making Occupations

8313	MODCOFOR	Machinist and Machine Tool Setting-up Occupations
8315	MODCOFOR	Machine Tool Operating Occupations
8316	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations, Metal Machining
8319	MODCOFOR	Metal Machining Occupations, n.e.c.
833	N.A.	Metal Shaping and Forming Occupations, Except Machining
8330	MODCOFOR	Foremen: Metal Shaping and Forming Occupations Except Machining
8331	CSSM	Forging Occupations
8333	MODCOFOR	Sheet Metal Workers
8334	MODCOFOR	Metalworking Machine Operators, n.e.c.
8335	MODCOFOR	Welding and Flame Cutting Occupations
8336	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations: Metal Shaping and Forming, Except Machining
8337	MODCOFOR	Boilermakers, Platers and Structural Metal Workers
8339	MODCOFOR	Metal Shaping and Forming Occupations, Except Machining, n.e.c.
835	N.A.	Wood Machining Occupations
8350	MODCOFOR	Foremen: Wood Machining Occupations
8351	MODCOFOR	Wood Patternmaking Occupations
8353	MODCOFOR	Wood Sawing and Related Occupations, Except Sawmill
8355	MODCOFOR	Planning, Turning, Shaping and Related Wood Machining Occupations

8356	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations, Wood Machining
8357	MODCOFOR	Wood Sanding Occupations
8359	MODCOFOR	Wood Machining Occupations, n.e.c.
837	N.A.	Clay, Glass and Stone and Related Materials Machining Occupations
8370	MODCOFOR	Foremen: Clay, Glass and Stone and Related Materials Machining Operations
8371	MODCOFOR	Cutting and Shaping Occupations: Clay, Glass and Stone
8373	MODCOFOR	Abrading and Polishing Occupations: Clay, Glass and Stone, n.e.c.
8376	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations: Clay, Glass and Stone Machining
8379	MODCOFOR	Clay, Glass and Stone and Related Materials Machining Occupations, n.e.c.
839	N.A.	Other Machining and Related Occupations
8390	MODCOFOR	Foremen: Other Machining and Related Occupations, n.e.c.
8391	MODCOFOR	Engravers, Etchers and Related Occupations
8393	MODCOFOR	Filing, Grinding, Buffing, Cleaning and Polishing Occupations, n.e.c.
8395	MODCOFOR	Patternmakers and Mouldmakers, n.e.c.
8396	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations, Machining, n.e.c.

8399	CSSM	Other Machining and Related Occupations, n.e.c.
851	N.A.	Fabricating and Assembling Occupations, Metal Products, n.e.c.
8510	MODCOFOR	Foremen: Fabricating and Assembling Occupations, Metal Products, n.e.c.
8511	MODCOFOR	Engine and Related Equipment Fabricating and Assembling Occupations, n.e.c.
8513	MODCOFOR	Motor Vehicle Fabricating and Assembling Occupations, n.e.c.
8515	MODCOFOR	Aircraft Fabricating and Assembling Occupations, n.e.c.
8523	MODCOFOR	Industrial, Farm, Construction and Other Mechanized Equipment and Machinery Fabricating and Assembling Occupations, n.e.c.
8525	MODCOFOR	Business and Commercial Machines Fabricating and Assembling Occupations, n.e.c.
8526	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations, Fabricating and Assembling Metal Products, n.e.c.
8527	MODCOFOR	Precision Instruments and Related Equipment Fabricating and Assembling Occupations, n.e.c.
8528	MODCOFOR	Occupations in Labouring and Other Elemental Work, Fabricating and Assembling Metal Products, n.e.c.
8529	MODCOFOR	Other Fabricating and Assembling Occupations, Metal Products, n.e.c.
853	N.A.	Fabricating, Assembling, Installing and Repairing Occupations: Electrical, Electronic and Related Equipment

8530	MODCOFOR	Foremen: Fabricating, Assembling, Installing and Repairing Occupations, Electrical, Electronic and Related Equipment
8531	MODCOFOR	Electrical Equipment Fabricating and Assembling Occupations
8533	CSSM	Electrical and Related Equipment Installing and Repairing Occupations, n.e.c.
8534	MODCOFOR	Electronic Equipment Fabricating and Assembling Occupations
8535	CSSM	Electronic and Related Equipment Installing and Repairing Occupations, n.e.c.
8536	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations: Fabricating, Assembling, Installing and Repairing Electrical, Electronic and Related Equipment
8537	CSSM	Radio and Television Service Repairmen
8538	MODCOFOR	Occupations in Labouring and Other Elemental Work: Fabricating, Assembling, Installing and Repairing Electrical, Electronic and Related Equipment
8539	MODCOFOR	Fabricating, Assembling, Installing and Repairing Occupations: Electrical, Electronic and Related Equipment, n.e.c.
854	N.A.	Fabricating, Assembling and Repairing Occupations, Wood Products
8540	MODCOFOR	Foremen: Fabricating, Assembling and Repairing Occupations, Wood Products
8541	MODCOFOR	Cabinet and Wood Furniture Makers
8546	MODCOFOR	Inspecting, Testlng, Grading and Sampling Occupations: Fabricating, Assembling and Repairing, Wood Products

8548	MODCOFOR	Occupations in Labouring and Other Elemental Work: Fabricating, Assembling and Repairing, Wood Products
8549	MODCOFOR	Fabricating, Assembling and Repairing Occupations, Wood Products, n.e.c.
855	N.A.	Fabricating, Assembling and Repairing Occupations: Textiles, Fur and Leather Products
8550	MODCOFOR	Foremen: Fabricating, Assembling and Repairing Occupations, Textiles, Fur and Leather Products
8551	MODCOFOR	Patternmaking, Marking and Cutting Occupations: Textiles, Fur and Leather Products
8553	CSSM	Tailors and Dressmakers
8555	MODCOFOR	Furriers
8557	MODCOFOR	Milliners, Hat and Cap Makers
8561	MODCOFOR	Shoemaking and Repairing Occupations
8562	MODCOFOR	Upholsterers
8563	MODCOFOR	Sewing Machine Operators, Textile and Similar Materials
8566	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations: Fabricating, Assembling and Repairing, Textiles, Fur and Leather Products
8568	MODCOFOR	Occupations in Labouring and Other Elemental Work: Fabricating, Assembling and Repairing, Textiles, Fur and Leather Products
8569	MODCOFOR	Fabricating, Assembling and Repairing Occupations: Textiles, Fur and Leather Products, n.e.c.

857	N.A.	Fabricating, Assembling and Repairing Occupations: Rubber, Plastic and Related Products, n.e.c.
8570	MODCOFOR	Foremen: Fabricating, Assembling and Repairing Occupations: Rubber, Plastic and Related Products
8571	MODCOFOR	Bonding and Cementing Occupations, Rubber, Plastic and Related Products
8573	MODCOFOR	Moulding Occupations, Rubber, Plastic and Related Products
8575	MODCOFOR	Cutting and Finishing, Rubber, Plastic and Related Products
8576	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations: Fabricating, Assembling and Repairing, Rubber, Plastic and Related Products
8578	MODCOFOR	Occupations in Labouring and Other Elemental Work: Fabricating, Assembling and Repairing, Rubber, Plastic and Related Products
8579	MODCOFOR	Fabricating, Assembling and Repairing Occupations: Rubber, Plastic and Related Products, n.e.c.
858	N.A.	Mechanics and Repairmen, Except Electrical
8580	CSSM	Foremen: Mechanics and Repairmen, Except Electrical
8581	CSSM	Motor Vehicle Mechanics and Repairmen
8582	MODCOFOR	Aircraft Mechanics and Repairmen
8583	MODCOFOR	Rail Transport Equipment Mechanics and Repairmen
8584	CSSM	Industrial, Farm and Construction Machinery Mechanics and Repairmen

8585	CSSM	Business and Commercial Machine Mechanics and Repairmen
8586	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations, Equipment Repair Except Electrical
8587	CSSM	Watch and Clock Repairmen
8588	CSSM	Precision Instrument Mechanics and Repairmen
8589	CSSM	Mechanics and Repairmen, Except Electrical, n.e.c.
859	N.A.	Other Product Fabricating, Assembling and Repairing Occupations
8590	MODCOFOR	Foremen: Product Fabricating, Assembling and Repairing Occupations, n.e.c.
8591	MODCOFOR	Jewellery and Silverware Fabricating, Assembling and Repairing Occupations
8592	MODCOFOR	Marine Craft Fabricating, Assembling and Repairing Occupations
8593	MODCOFOR	Paper Product Fabricating and Assembling Occupations
8595	MODCOFOR	Painting and Decorating Occupations, Except Construction
8596	MODCOFOR	Inspecting, Testing, Grading and Sampling Occupations: Product Fabricating, Assembling and Repairing, n.e.c.
8598	MODCOFOR	Occupations in Labouring and Other Elemental Work: Product Fabricating, Assembling and Repairing, n.e.c.
8599	MODCOFOR	Other Product Fabricating, Assembling and Repairing Occupations, n.e.c.
871	N.A.	Excavating, Grading, Paving and Related Occupations

8710	CSSM	Foremen: Excavating, Grading, Paving and Related Occupations
8711	CSSM	Excavating, Grading and Related Occupations
8713	CSSM	Paving, Surfacing and Related Occupations
8715	MODCOFOR	Railway Sectionmen and Trackmen
8718	CSSM	Occupations in Labouring and Other Elemental Work: Excavating, Grading and Paving
8719	CSSM	Excavating, Grading, Paving and Related Occupations, n.e.c.
873	N.A.	Electrical Power, Lighting and Wire Communications Equipment Erecting, Installing and Repairing Occupations
8730	CSSM	Foremen: Electrical Power, Lighting and Wire Communications Equipment Erecting Installing and Repairing Occupations
8731	MODCOFOR	Electrical Power Linemen and Related Occupations
8733	CSSM	Construction Electricians and Repairmen
8735	MODCOFOR	Wire Communications and Related Equipment Installing and Repairing Occupations
8736	CSSM	Inspecting, Testing, Grading and Sampling Occupations: Electrical Power, Lighting and Wire Communications Equipment Erecting, Installing and Repairing
8738	MODCOFOR	Occupations in Labouring and Other Elemental Work: Electrical Power Lighting and Wire Communications Equipment Erecting, Installing and Repairing

8739	MODCOFOR	Electrical Power, Lighting and Wire Communications Equipment Erecting, Installing and Repairing Occupations, n.e.c.
878	N.A.	Other Construction Trades Occupations
8780	CSSM	Foremen: Other Construction Trades Occupations
8781	CSSM	Carpenters and Related Occupations
8782	CSSM	Brick and Stone Masons and Tile Setters
8783	CSSM	Concrete Finishers and Related Occupations
8784	CSSM	Plasterers and Related Occupations
8785	CSSM	Painters, Paperhangers and Related Occupations
8786	CSSM	Insulating Occupations, Construction
8787	CSSM	Roofing, Waterproofing and Related Occupations
8791	CSSM	Pipe Fitting, Plumbing and Related Occupations
8793	MODCOFOR	Structural Metal Erectors
8795	CSSM	Glaziers
8796	CSSM	Inspecting, Testing, Grading and Sampling Occupations, Construction Except Electrical
8798	CSSM	Occupations in Labouring and Other Elemental Work, Other Construction Trades
8799	CSSM	Other Construction Trades Occupations, n.e.c.
911	N.A.	Air Transport Operating Occupations

9110	MODCOFOR	Foremen: Air Transport Operating Occupations
9111	MODCOFOR	Air Pilots, Navigators and Flight Engineers
9113	MODCOFOR	Air Transport Operating Support Occupations
9119	MODCOFOR	Air Transport Operating Occupations, n.e.c.
913	N.A.	Railway Transport Operating Occupations
9130	MODCOFOR	Foremen: Railway Transport Operating Occupations
9131	MODCOFOR	Locomotive Engineers and Firemen
9133	MODCOFOR	Conductors and Brakemen, Railway
9135	MODCOFOR	Railway Transport Operating Support Occupations
9139	MODCOFOR	Railway Transport Operating Occupations, n.e.c.
915	N.A.	Water Transport Operating Occupations
9151	MODCOFOR	Deck Officers
9153	MODCOFOR	Engineering Officers, Ship
9155	MODCOFOR	Deck Crew, Ship
9157	MODCOFOR	Engine and Boiler-room Crew, Ship
9159	MODCOFOR	Water Transport Operating Occupations, n.e.c.
917	N.A.	Motor Transport Operating Occupations
9170	MODCOFOR	Foremen: Motor Transport Operating Occupations
9171	CSSM	Bus Drivers
9173	MODCOFOR	Taxi Drivers and Chauffeurs

9175	CSSM	Truck Drivers
9179	MODCOFOR	Motor Transport Operating Occupations, n.e.c.
919	N.A.	Other Transport Equipment Operating Occupations
9190	MODCOFOR	Foremen: Other Transport and Related Equipment Operating Occupations
9191	MODCOFOR	Subway and Street Railway Operating Occupations
9193	MODCOFOR	Motormen and Dinkeymen, Except Rail Transport
9199	MODCOFOR	Other Transport and Related Equipment Operating Occupations, n.e.c.
931	N.A.	Material Handling and Related Occupations, n.e.c.
9310	CSSM	Foremen: Materials Handling and Related Occupations, n.e.c.
9311	MODCOFOR	Hoisting Occupations, n.e.c.
9313	CSSM	Longshoremen, Stevedores and Freight Handlers
9315	CSSM	Materials-handling Equipment Operators, n.e.c.
9317	MODCOFOR	Packaging Occupations, n.e.c.
9318	CSSM	Occupations in Labouring and Other Elemental Work, Materials Handling
9319	CSSM	Materials Handling and Related Occupations, n.e.c.
951	N.A.	Printing and Related Occupations
9510	MODCOFOR	Foremen: Printing and Related Occupations
9511	MODCOFOR	Typesetters and Compositors
9512	MODCOFOR	Printing Press Occupations
9513	MODCOFOR	Stereotypers and Electrotypers

9514	MODCOFOR	Printing Engravers, Except Photoengravers
9515	MODCOFOR	Photoengravers and Related Occupations
9517	MODCOFOR	Bookbinders and Related Occupations
9518	MODCOFOR	Occupations in Labouring and Other Elemental Work, Printing and Related, n.e.c.
9519	MODCOFOR	Printing and Related Occupations, n.e.c.
953	N.A.	Stationary Engine and Utilities Equipment Operating and Related Occupations
9530	MODCOFOR	Foremen: Stationary Engine and Utilities Equipment Operating and Related Occupations
9531	MODCOFOR	Power Station Operators
9539	CSSM	Stationary Engine and Utilities Equipment Operating and Related Occupations, n.e.c.
955	N.A.	Electronic and Related Communications Equipment Operating Occupations, n.e.c.
9550	MODCOFOR	Foremen: Electronic and Related Communications Equipment Operating Occupations, n.e.c.
9551	MODCOFOR	Radio and Television Broadcasting Equipment Operators
9553	MODCOFOR	Telegraph Operators
9555	CSSM	Sound Recording and Reproduction Equipment Operators
9557	CSSM	Motion Picture Projectionists

9559	MODCOFOR	Electronic and Related Communications Equipment Operating Occupations, n.e.c.
959	N.A.	Other Crafts and Equipment Operating Occupations, n.e.c.
9590	CSSM	Foremen: Other Crafts and Equipment Operating Occupations, n.e.c.
9591	CSSM	Photographic Processing Occupations
9599	CSSM	Other Crafts and Equipment Operating Occupations, n.e.c.
9910	CSSM	Supervisors and Foremen, n.e.c.
9916	CSSM	Inspecting, Testing, Grading and Sampling Occupations, n.e.c.
992	CSSM	Labourers, n.e.c. in (9918)
9919	CSSM	Other Occupations, n.e.c.
0000	CSSM	Occupations Not Stated

APPENDIX B

SUMMARY OF DATA SOURCES AND INDUSTRY GROUPINGS

In this appendix we will outline the data sources used by both the CSSM (Cross-Sectional Stochastic Model) and the MODCOFOR (modified Canadian Occupational Forecasting) model. First, in the estimation stage of the CSSM exercise (see equation (1) of the text) we drew our employment data by occupation and industry from the 1971 Census of Canada. The real domestic product (output) and the mid-year capital stock by 34 industries were extracted from the CANDIDE 2.0 Databank which originated of course with Statistics Canada. For the forecasting stage (see equation (2) of the text) we made use of the projected industry employment, output and capital figures residing in CANDIDE 2.0's Solutionbank.

As far as MODCOFOR is concerned, we utilized both the 1971 Census and the 1975 Occupational Employment Survey, like COFOR, but calculated 35 base year occupation-to-industry-employment ratios (see equation (4) of the text) instead of COFOR's 69. To project occupational employment using these coefficients, we made use of the industry employment figures as projected by CANDIDE 2.0.

Finally, in the table below we present the industry groupings employed throughout the analyses. Both methods, above, basically used this breakdown. However, it should be noted that CSSM, because CANDIDE 2.0 separates motor vehicles (MOH) motor

vehicle parts and accessories (MMOP) for its employment figures but not for its output and capital stock, is based on 34 industries. The table also indicates what Standard Industrial Classification (SIC) codes were aggregated to make up each of the industry groups.

APPENDIX B

Table 1

Industry Groupings Used in the Forecasting Exercise[1]

Ind. no.	Mnemonic	Industry Description	Standard Industrial Classification (1970 SIC) codes of component industries
1	AFT	Agriculture, Fishing, Trapping	001, 003, 011, 013, 015, 017, 019, 021, 041, 045, 047
2	CON	Construction	404, 406, 409, 421
3	TS&CØM	Transportation, Communication	501 to 509, 512, 515 to 517, 519, 524, 527, 543 to 545, 548
4	FIN	Finance, Insurance, Real Estate	701, 703, 705, 707, 715, 721, 735, 737
5	FOR	Forestry	831, 839
6	ADM	Public Admin. (All Levels)	902, 909, 951, 931
7	MWO	Mfg - Wood Products	251, 252, 254, 256, 258, 259
8	MFUR	Mfg - Furniture & Fixtures	261, 264, 266, 268
9	MFUR	Mfg - Iron & Steel	291, 292, 294
10	MNOF	Mfg - Non-Ferrous Metal	295 to 298
11	MMEF	Mfg - Metal	301 to 309
12	MACH	Mfg - Machinery (Excl. Electrical)	311, 315, 316, 318
13	MAUT	Mfg - Non Auto Transportation Equipment	321, 326 to 329
14	MOH[2]	Mfg - Motor Vehicle (Excl. Parts)	323, 324
15	MMOP[2]	Mfg - Motor Vechile Parts	325
16	MEL	Mfg - Electrical Products	331 to 336, 338, 339
17	MNOME	Mfg - Non-Metallic Mineral Products	351 to 359
18	MFB	Mfg - Food & Beverages	101 to 109
19	MTØ	Mfg - Tobacco Products	151, 153
20	MRU	Mfg - Rubber and Plastic Products	162, 165
21	MLE	Mfg - Leather & Leather Products	172, 174, 175, 179
22	MTX	Mfg - Textiles	181 to 189
23	MKN	Mfg - Knitting Mills & Clothing	231, 239, 243 to 246, 248, 249
24	MPA	Mfg - Paper & Allied Industries	271 to 274
25	MPR	Mfg - Printing, Publishing & Allied	286 to 289
26	MPE	Mfg - Petroleum and Coal	365, 369
27	MCC	Mfg - Chemicals and Chemical Products	372 to 379
28	MMS	Mfg - Miscellaneous	391 to 393, 397, 399
29	MICØ	Mining - Coal	061
30	MIPET	Mining - Petroleum, Natural Gas	064, 096, 098, 099
31	MIMET	Mining - Metal	051, 052, 057 to 059
32	MINØM	Mining - Non-Metal	071 to 073, 079, 083, 087
33	SER	Commercial & Non-Commercial Services	822 to 827, 841 to 843, 845, 849, 851, 853, 855, 861 to 864, 866, 867, 869, 871, 872, 874, 876, 877, 879, 881, 884, 886, 893 to 899, 828, 831, 844, 873, 883, 891
34	TRADE		602, 606, 608, 611, 612, 614 to 619, 621 to 627, 629, 631, 642, 652, 654, 656, 658, 663, 665, 667, 669, 673, 676, 678, 681, 691, 692, 694 to 697, 679
35	UTIL	Utilities	572, 574, 576, 579

1 The source of the data for the CSSM is the 1971 Census and CANDIDE 2.0 and the MODCOFOR model it is the 1971 Census and primarily the 1975 Occupational Employment Survey.

2 For CSSM, Motor Vehicles and Motor Vehicle Parts were combined because output and capital data are collected for the combined industries only.

Appendix B: The Evolution of Industrial Employment, Canada, 1971-81 (Actual), 1982-90 (Projected)

	Employment Growth (E)	Employment Growth (AGET+FT)	Employment Share (AGET+FT)	Employment Growth (POET)	Employment Share (FOEI)	Employment Growth (MIET)	Employment Share (MIET)	Employment Growth (COET)	Employment Share (COET)	Employment Growth (MAET)	Employment Share (MAET)
1971	2.4	0.6	6.6	0.0	0.9	2.4	1.6	4.7	6.1	-0.1	22.2
1972	2.9	-6.0	5.9	-1.4	0.9	-3.9	1.5	1.0	6.0	3.2	22.3
1973	4.9	-2.3	5.5	11.4	0.9	-0.8	1.4	4.1	6.3	5.9	22.4
1974	4.1	0.8	5.3	2.0	0.9	2.5	1.4	8.7	6.5	2.6	22.1
1975	1.6	1.1	5.3	-12.5	0.8	4.0	1.4	1.0	6.5	-4.0	20.4
1976	2.1	-2.7	5.0	17.1	0.9	4.6	1.5	5.4	6.7	2.7	21.0
1977	1.7	-1.3	4.9	-1.2	0.9	4.4	1.5	-0.3	6.6	-1.7	20.3
1978	3.3	2.4	4.8	11.1	0.9	4.2	1.5	-0.2	6.4	3.6	20.3
1979	4.0	3.2	4.8	-4.4	0.8	5.4	1.5	1.4	6.2	5.9	20.7
1980	2.8	0.2	4.7	-4.7	0.8	15.4	1.7	-3.5	5.8	1.8	20.5
1981	4.7	6.3	4.8	-7.3	0.7	12.2	1.8	6.1	5.9	-0.9	19.4
1982	8.1	-1.2	4.3	0.6	0.6	9.3	2.2	1.9	5.7	1.6	19.7
1983	5.1	-0.8	4.1	-1.2	0.6	7.2	2.3	3.5	5.7	1.7	19.4
1984	2.4	-1.2	3.9	-5.2	0.6	4.5	2.3	2.4	5.7	1.2	19.1
1985	1.8	-1.0	3.8	-0.8	0.5	5.7	2.4	1.7	5.7	0.2	18.9
1986	1.9	-1.3	3.7	-3.5	0.5	2.1	2.4	2.5	5.7	0.1	18.5
1987	2.0	-1.2	3.6	-1.3	0.5	2.6	2.4	2.9	5.8	0.4	18.2
1988	1.4	-1.2	3.5	-2.9	0.4	2.8	2.4	0.3	5.7	0.1	18.0
1989	1.4	-1.4	3.4	-3.4	0.4	3.1	2.5	0.4	5.7	0.4	17.8
1990	1.5	-1.3	3.3	-2.1	0.4	2.6	2.5	1.0	5.6	0.8	17.7

Industry Mnemonics: AGET+FT = agriculture plus fishing and trapping; POEF forestry;
MIET = Mines, quarries and oil wells; COET = construction; MAET = manufacturing
TRET = Trade; TSET = transportation and communication; UTET = utilities; FIET = finance, insurance and real estate;
CMET = community, business and personal service; ADET = public administration; GOODET = goods producing industries (including forestry, fishing and trapping, mines, quarries and oil wells, manufacturing, and construction;
SERVET = service producing industries (including transportation; communication and other utilities; trade; finance; insurance and real estate; community, business and personal service; public administration)

Notes:

1 Employment share is defined to be (industry employment/total employment) * 100.

2 Employment growth figures are year to year percentage changes.

Appendix B (continued)
The Evolution of Industrial Employment, Canada, 1971-81 (Actual), 1982-90 (Projected)

	Employment Growth (TRET)	Employment Share (TRET)	Employment Growth (TSET)	Employment Share (TSET)	Employment Growth (UTET)	Employment Share (UTET)	Employment Growth (FIET)	Employment Share (FIET)	Employment Growth (CMET)	Employment Share (CMET)
1971	0.6	16.5	1.8	7.7	-2.3	1.1	5.2	4.8	4.4	26.2
1972	6.0	17.0	6.3	7.7	7.0	1.1	-0.3	4.7	3.4	26.3
1973	5.9	17.1	5.4	7.7	6.5	1.1	6.3	4.7	3.9	26.1
1974	5.0	17.3	2.7	7.6	-3.1	1.1	8.4	4.9	4.2	26.1
1975	5.4	17.6	1.0	7.6	7.4	1.1	2.7	5.0	4.9	27.0
1976	0.5	17.3	1.3	7.5	3.1	1.1	4.6	2.1	2.1	27.0
1977	2.1	17.3	-0.3	7.4	-2.8	1.1	7.2	5.4	4.6	27.7
1978	3.5	17.4	3.6	7.4	9.7	1.9	2.8	5.3	4.2	28.0
1979	3.9	17.3	5.7	7.5	-1.8	1.1	1.3	5.2	4.8	28.2
1980	1.5	17.1	-0.4	7.2	5.4	1.1	9.8	5.6	4.7	28.7
1981	4.9	17.2	2.4	7.1	8.5	1.2	2.1	5.4	8.0	29.6
1982	2.8	17.2	0.1	6.8	1.3	1.2	6.1	6.0	5.0	29.6
1983	3.7	17.3	0.4	6.6	1.7	1.2	4.7	6.0	4.4	30.0
1984	2.8	17.3	0.2	6.9	1.9	1.2	2.6	6.1	4.0	30.5
1985	2.3	17.4	0.1	6.4	2.0	1.2	1.8	6.1	3.2	30.9
1986	2.4	17.5	0.1	6.3	1.2	1.1	1.7	6.0	3.6	31.4
1987	3.1	17.7	0.3	6.2	1.2	1.1	1.3	6.0	3.1	31.8
1988	2.2	17.9	-0.1	0.1	1.8	1.1	0.9	6.0	2.5	32.1
1989	2.0	17.9	-0.2	6.0	1.2	1.1	1.2	6.0	2.4	32.4
1990	2.2	18.1	-0.1	5.9	1.2	1.1	0.8	5.9	2.2	32.6

ppendix B (continued)
he Evolution of Industrial Employment, Canada, 1971-81 (Actual),
982-90 (Projected)

	Employment Growth (ADET)	Employment Share (ADET)	Employment Growth (GOODET)	Employment Share (GOODET)	Employment Growth (SERVET)	Employment Share (SERVET)
971	6.8	6.5	1.0	30.8	3.2	62.7
972	6.2	6.7	2.2	30.6	4.1	63.5
973	5.3	6.7	6.2	31.0	5.0	63.5
974	4.9	6.7	3.9	30.9	4.5	63.7
975	4.1	6.9	-2.8	29.6	3.8	65.1
976	1.9	6.9	3.8	30.1	1.8	64.9
977	3.1	7.0	-1.1	29.2	3.3	65.9
978	0.8	6.8	3.0	29.1	3.6	66.0
979	0.2	6.6	4.6	29.3	3.8	65.9
980	4.9	6.7	1.2	28.8	3.7	66.5
981	8.7	7.0	1.1	27.8	6.2	67.4
982	2.8	6.8	2.2	28.2	3.7	67.5
983	2.4	6.8	2.4	28.0	3.6	67.9
984	2.3	6.7	1.6	27.8	3.0	68.3
985	2.0	6.8	0.6	27.5	2.4	68.7
986	1.9	6.8	0.7	27.1	2.6	69.1
987	1.8	6.7	1.1	26.9	2.5	69.5
988	1.8	6.8	0.3	26.6	2.0	69.9
989	1.6	6.8	0.6	26.4	1.9	70.2
990	1.6	6.8	1.0	26.2	1.8	70.4

Appendix C

Summary of Observed and Projected Vacancies for Selected Occupations*

Occupation Code (CCDO)	Observed vacancies 1971-78 average	Projected vacancies 1981-85 average	Observed vacancy share (%) 1971-78 average	Projected vacancy share (%) 1981-85 average	Observed vacancy growth (%) 1971-78 annual average	Projected vacancy growth (%) 1981-85 annual average
113	704.1	1,108.5	1.2	1.5	11.4	8.9
117	1,364.1	2,827.5	2.4	3.7	18.0	10.2
211	292.8	597.3	0.5	0.8	16.9	10.0
214	1,226.9	2,517.3	2.1	3.3	13.3	12.7
216	1,438.2	2,940.0	2.3	3.8	17.9	14.1
218	449.6	1,110.2	0.8	1.5	21.5	10.5
231	192.1	323.5	0.3	0.4	6.5	12.9
233	402.6	583.2	0.7	0.8	4.5	5.9
234	64.5	132.0	0.1	0.2	16.7	11.9
235	127.4	182.3	0.2	0.2	3.9	8.4
239	58.8	132.5	0.1	0.2	13.8	9.2
25	22.4	42.9	0.0	0.1	13.3	4.8
271	176.9	275.9	0.3	0.4	6.0	1.7
273	232.3	293.6	0.4	0.4	3.3	8.7
279	279.1	487.6	0.5	0.6	10.4	7.7
311	106.3	89.5	0.2	0.1	-3.5	7.7
313	2,565.8	3,049.1	4.1	3.9	-2.3	12.5
315	551.3	514.6	1.0	0.7	-2.9	4.0

* Notes: (1) Rows 1-76 do not add up to the total due to rounding and minor omissions.
(2) Vacancy share denotes (vacancies of a three digits CCDO occupation/total vacancies) X 100.
(3) See Appendix for occupation description.

Source: Statistics Canada's data and Economic Council of Canada's own estimates.

Appendix C (continued)

Summary of Observed and Projected Vacancies for Selected Occupations*

Occupation Code (CCDO)	Observed vacancies 1971-78 average	Projected vacancies 1981-85 average	Observed vacancy share (%) 1971-78 average	Projected vacancy share (%) 1981-85 average	Observed vacancy growth (%) 1971-78 annual average	Projected vacancy growth (%) 1981-85 annual average
331	226.2	383.4	0.4	0.5	4.1	8.1
333	59.3	102.3	0.1	0.1	8.9	9.5
335	125.5	259.4	0.2	0.3	14.0	7.0
337	91.8	189.9	0.2	0.2	7.4	9.3
411	3,398.5	4,593.0	5.7	5.8	2.4	9.5
413	1,959.6	3,080.7	3.3	3.9	6.7	10.7
414	519.3	869.2	0.8	1.1	5.1	13.2
415	836.0	1,092.4	1.4	1.4	3.9	13.4
416	234.9	351.9	0.4	0.4	2.7	8.8
417	931.1	1,372.3	1.5	1.7	7.3	9.8
419	1,965.3	2,719.0	3.6	3.4	4.0	11.4
513	4,085.6	3,536.1	6.8	4.5	-3.7	7.4
517	1,490.4	604.9	2.6	0.8	-2.8	-6.9
519	240.9	103.3	0.4	0.1	-10.0	13.6
611	1,203.0	1,344.0	1.9	1.7	1.2	16.1
612	3,598.4	5,633.9	5.6	7.1	3.5	15.1
613	307.1	543.9	0.5	0.7	11.8	13.4
614	1,062.6	889.7	1.7	1.1	-6.7	11.6
616	242.1	250.6	0.4	0.3	-9.2	6.9
619	1,061.3	1,560.7	1.7	2.0	4.9	14.6
71	272.3	124.2	0.5	0.2	-9.3	0.0
73	41.3	58.9	0.1	0.1	5.4	4.8
75	1,295.2	714.2	1.9	0.9	-10.1	11.3
77	836.9	1,224.0	1.4	1.5	3.7	12.5
811	73.3	78.4	0.1	0.1	-10.7	9.6

Appendix C (continued)

Summary of Observed and Projected Vacancies for Selected Occupations*

Occupation Code (CCDO)	Observed vacancies 1971-78 average	Projected vacancies 1981-85 average	Observed vacancy share (%) 1971-78 average	Projected vacancy share (%) 1981-85 average	Observed vacancy growth (%) 1971-78 annual average	Projected vacancy growth (%) 1981-85 annual average
813	585.5	1,117.2	0.8	1.4	8.1	26.3
815	115.4	153.6	0.2	0.2	-2.4	14.9
816	277.5	384.2	0.5	0.5	5.4	10.7
821	1,109.6	384.1	1.7	0.5	1.1	-1.0
823	149.8	120.5	0.2	0.2	-4.2	12.8
825	60.5	95.5	0.1	0.1	11.5	10.1
826	314.3	331.9	0.5	0.4	-7.6	17.5
829	49.1	7.9	0.1	0.0	-10.2	-31.6
831	1,307.7	2,440.5	2.1	3.1	18.7	16.0
833	1,766.7	2,800.7	2.6	3.5	6.4	20.0
835	138.5	150.7	0.2	0.2	-1.6	22.8
837	71.3	68.2	0.1	0.1	-3.7	14.6
839	196.2	293.4	0.3	0.4	9.7	13.6
851	682.0	1,376.8	1.1	1.7	18.3	14.8
853	1,135.8	1,166.5	1.8	1.5	2.4	15.6
854	476.3	493.2	0.7	0.6	-1.1	16.9
855	2,732.3	1,593.5	4.4	2.0	-6.2	10.2
857	378.0	586.9	0.6	0.7	3.0	21.2
858	3,453.0	4,791.3	5.5	6.0	5.4	13.5
859	514.1	661.9	0.8	0.8	-0.1	17.3
871	405.6	584.5	0.7	0.7	0.5	10.7
873	588.4	670.7	1.0	0.8	-3.7	10.9
878	2,887.3	3,653.2	4.6	4.6	-2.8	13.6
911	87.0	48.8	0.2	0.1	-16.3	6.4
913	44.1	124.3	0.1	0.2	21.6	9.1

Appendix C (continued)

Summary of Observed and Projected Vacancies for Selected Occupations*

Occupation Code (CCDO)	Observed vacancies 1971-78 average	Projected vacancies 1981-85 average	Observed vacancy share (%) 1971-78 average	Projected vacancy share (%) 1981-85 average	Observed vacancy growth (%) 1971-78 annual average	Projected vacancy growth (%) 1981-85 annual average
915	63.8	132.0	0.1	0.2	12.2	14.4
917	1,764.2	1,936.4	2.8	2.4	-1.7	14.2
919	39.8	113.2	0.1	0.1	28.0	8.4
93	1,743.0	1,221.6	2.7	1.5	-6.7	18.5
951	350.2	575.1	0.6	0.7	5.5	12.9
953	298.2	530.6	0.5	0.7	4.7	12.5
955	35.3	68.6	0.1	0.1	6.0	8.8
959	39.1	87.4	0.1	0.1	11.7	13.2
Total vacancies	16,816.0	79,334.0	100.0	100.0	2.5	12.6

Appendix D

Summary of Occupational Employment Projections

Occupation Code (CCDO)	Projected Occupational Employment Growth 1981-85 average	Projected Occupational Employment Growth 1986-90 average	Projected Occupational Employment Share 1981-85 average	Projected Occupational Employment Share 1986-90 average
113	2.33	0.85	2.3%	2.2%
117	2.85	1.13	2.3	2.3
211	3.20	1.25	0.4	0.4
213	2.84	1.41	0.2	0.2
214	3.28	1.30	1.0	1.0
216	3.06	1.20	0.9	0.9
218	2.87	1.11	0.3	0.3
231	2.62	1.19	0.1	0.1
233	2.63	1.17	0.3	0.3
234	2.61	1.27	0.3	0.3
235	2.62	1.23	0.1	0.1
239	3.15	1.48	0.1	0.1
25	4.22	2.56	0.3	0.3
271	-0.03	-1.26	0.9	1.0
273	-0.82	1.40	3.9	4.2
279	-0.10	-0.46	0.6	0.6
311	2.59	1.28	0.5	0.5
313	3.09	1.68	3.4	3.5
315	2.62	1.21	0.7	0.7
331	1.75	0.61	0.3	0.3
333	2.39	1.14	0.2	0.2
335	2.96	1.12	0.2	0.2

Source: Economic Council of Canada's own estimates.

Appendix D (continued)

Summary of Occupational Employment Projections

Occupation Code (CCDO)	Projected Occupational Employment Growth 1981-85 average	Projected Occupational Employment Growth 1986-90 average	Projected Occupational Employment Share 1981-85 average	Projected Occupational Employment Share 1986-90 average
337	2.73	1.32	0.2	0.2
411	2.63	1.07	4.0	4.0
413	2.82	1.05	4.5	4.5
414	2.64	0.99	0.6	0.6
415	2.17	0.71	1.7	1.7
416	2.63	1.13	0.4	0.4
417	1.97	0.83	1.7	1.7
419	3.60	1.50	3.5	3.7
513	2.57	1.12	8.2	8.1
517	3.58	1.07	1.3	1.3
519	2.65	1.78	0.2	0.2
611	2.65	1.48	1.4	1.4
612	2.62	1.26	3.1	3.1
613	2.92	1.48	0.5	0.5
614	2.62	1.27	1.8	1.8
616	1.93	0.87	0.4	0.4
619	2.63	1.17	2.8	2.7
71	-0.49	-0.83	4.4	3.8
73	-0.63	-0.84	0.2	0.2
75	-1.53	-1.08	0.5	0.4
77	6.04	2.90	0.7	0.8
811	4.97	3.24	0.1	0.1

Appendix D (continued)

Summary of Occupational Employment Projections

Occupation Code (CCDO)	Projected Occupational Employment Growth 1981-85 average	Projected Occupational Employment Growth 1986-90 average	Projected Occupational Employment Share 1981-85 average	Projected Occupational Employment Share 1986-90 average
813	2.38	-0.22	0.7	0.6
815	2.32	1.23	0.2	0.2
816	0.87	0.90	0.5	0.5
821	0.51	0.18	1.4	1.3
823	3.36	1.37	0.5	0.5
825	1.09	2.24	0.4	0.4
826	0.49	-0.80	0.4	0.3
829	1.11	-0.21	0.1	0.1
831	1.54	0.28	0.8	0.8
833	2.04	0.76	1.6	1.5
835	2.90	0.94	0.1	0.1
837	3.02	1.62	0.1	0.1
839	2.13	0.44	0.2	0.2
851	0.88	0.12	0.8	0.7
853	2.17	0.80	1.1	1.0
854	2.81	0.85	0.3	0.3
855	0.65	0.01	1.7	1.6
857	1.02	1.94	0.5	0.4
858	2.43	0.92	3.0	2.9
859	1.89	1.58	0.8	0.7
873	2.21	0.90	1.3	1.3

Appendix D (continued)

Summary of Occupational Employment Projections

Occupation Code (CCDO)	Projected Occupational Employment Growth 1981-85 average	Projected Occupational Employment Growth 1986-90 average	Projected Occupational Employment Share 1981-85 average	Projected Occupational Employment Share 1986-90 average
878	2.66	0.96	4.2	4.3
911	0.94	0.39	0.2	0.1
913	0.42	-0.05	0.3	0.3
915	0.95	0.56	0.2	0.2
917	2.48	0.96	3.0	2.9
919	3.35	1.96	0.1	0.1
93	2.25	0.97	2.4	2.4
951	1.96	1.59	0.7	0.6
953	3.39	1.53	0.6	0.6
955	1.51	0.82	0.1	0.1
959	2.63	1.14	0.1	0.1

References

Ahmad, B. (1969), A Projection of Manpower Requirements by Occupation in 1975, (Ottawa: Queen's Printer).

Berndt, E. R., G. C. Watkins (1981), Energy Prices and Productivity Trends in the Canadian Manufacturing Sector, 1957-76: Some Exploratory Results, (Ottawa: Supply and Services Canada).

Betcherman, Gordon (1982), Meeting Skill Requirements: Analysis of the Human Resources Survey, (Ottawa: Supply and Services Canada).

Bunch, Susan W., and Ruth A. Fabricant (1968), "A Further Comment on the Behaviour of Help-Wanted Advertising", The Review of Economics and Statistics 50, May 1968, pp. 278-281.

Bunch, Susan W., and Ruth A. Fabricant (1971), "Cyclical Behavior of Help-Wanted Index and the Unemployment Rate: A Reply", The Review of Economics and Statistics 53, February 1971, pp. 105-106.

Cohen, Malcolms, and Robert Solow (1967), "The Behaviour of Help-Wanted Advertising", The Review of Economics and Statistics 49, February 1967, pp. 105-106.

Conference Board in Canada (1977), The AERIC Short-Term Quarterly Forecasting Model of the Canadian Economy, (Ottawa: Conference Board in Canada).

Denton, F.T., C.H. Feaver, and A.L. Robb (1975), "Patterns of Unemployment Behavior in Canada", Discussion Paper No. 36 (Ottawa: Economic Council of Canada).

Dow, J.C.R., and L.A. Dicks-Mireau (1958), "The Excess Demand for Labour: A Study of Conditions in Great Britain, 1946-56", Oxford Economic Papers 10, February 1958, pp. 1-33.

Department of Manpower and Immigration (1971), The Canadian Classification and Dictionary of Occupations, (Ottawa: Information Canada).

Economic Council of Canada (1976), People and Jobs, (Ottawa: Information Canada).

Economic Council of Canada (1980), CANDIDE 2.0: Model Description, Volumes 1 and 2, (Ottawa: Supply and Services Canada).

Economic Council of Canada (1981), Eighteenth Annual Review, 1981: Room for Manoeuvre, (Ottawa: Supply and Services Canada).

Foot, David K. (1980), Labour Market Analysis with Canadian Macroeconometric Models: A Review, (Toronto: Center for Industrial Relations, University of Toronto).

Foot, David K., Noah M. Meltz, and Farid Siddiqui, ed. (1980), Manpower Forecasting in Canada: A Discussion of the Issues, (Toronto: Center for Industrial Relations, University of Toronto).

Freeman, Richard B., and D. Breneman (1974), Forecasting the Ph.D. Labour Market, National Board of Graduate Education, Technical Report No. 2.

Freeman, Richard B. (1980), "An Empirical Analysis of the Fixed Coefficient 'Manpower Requirement' Model, 1960-1970", The Journal of Human Resources 15, Spring 1980, pp. 176-199.

Glejser, H. (1969), "A New Test for Heteroskedasticity", Journal of the American Statistical Association 64, pp. 316-323.

Grubel, H.G., D. Maki, and S.G. Sax (1975), "Real and Insurance Induced Unemployment in Canada", Canadian Journal of Economics 8, May 1975, pp. 174-191.

Gujarati, Damodar (1969), "Cyclical Behavior of Help-Wanted Index and the Unemployment Rate", The Review of Economics and Statistics 51, November 1969, pp. 482-484.

Hansen, Bent (1970), "Excess Demand, Unemployment, Vacancies, and Wages", Quarterly Journal of Economics 84, February 1970, pp. 1-23.

Harvey, E.B., and K.S.R. Murthy (1975), Supply of and Demand for New Graduates in Engineering, Chemistry, Business and Commerce (Toronto: Technical Services Council).

Harvey, E.B., and K.S.R. Murthy (1976), Engineering Manpower Demand and Supply: Further Estimates, (Toronto: Technical Services Council).

Harvey, E.B., and K.S.R. Murthy (1979), Supply of and Demand for Accounting Professionals in Canada, (Toronto: Technical Services Council).

Helliwell, J.F., H.T. Shapiro, G.R. Sparks, I.A. Stewart, F.W. Gorbet and D.R. Stephenson (1971), The Structure of RDX2, Bank of Canada Staff Research Studies No. 7, (Ottawa: Bank of Canada).

Holt, Charles, and M. David (1966), "The Concept of Job Vacancies in a Dynamic Theory of the Labour Market", in The Measurement and Interpretation of Job Vacancies, National Bureau of Economic Research (Ney York: Columbia University Press), pp. 73-110.

Institute for Policy Analysis (1978 a), The FOCUS Model, (Toronto: Institute for Policy Analysis).

Institute for Policy Analysis (1978 b), The TRACE Model, (Toronto: Institute for Policy Analysis).

Kendall, Maurice (1980), Multivariate Analysis, 2nd ed., (London: Charles Griffin and Company Limited).

Kennedy, Peter (1979), A Guide to Econometrics, (Cambridge: The MIT Press).

Leckie, N. (1981), "Evidence of Skill Shortages in Canada", mimeo, Economic Council of Canada, Ottawa.

Library of Parliament (1981), Special Committee on Employment Opportunities for the 80s: Synthesis of the Evidence, (Ottawa: Library of Parliament).

Lipsey, R.G. (1960), "The Relation Between Unemployment and The Rate of Change of Money Wage Rates in the United Kingdom, 1862-1957: A Further Analysis", Economica 27, February 1960, pp. 1-31.

Lipsey, R.G. (1974), "The Micro Theory of the Phillips" Curve Reconsidered: A Reply to Holmes and Smyth, Economica 41, February 1974.

Macrae, C., and S. Schweitzer (1970), "Help-Wanted Advertising, Aggregate Unemployment, and Structural Change", Proceedings of the 23rd Annual Meeting of the Industrial Relations Research Association, pp. 87-96.

Maddala, G.S. (1977), Econometrics, (New York: McGraw-Hill Book Company).

Ministry of State, Science and Technology Canada (1978 a), Methodology: MOSST HQM Demand Model, (Ottawa: MOSST).

Ministry of State, Science and Technology Canada (1978 b), The Demand for Engineering Graduates to 1985, (Ottawa: MOSST).

Ministry of State, Science and Technology Canada (1978 c), Recent Hiring Patterns at Canadian Universities: A Statistical Analysis, (Ottawa: MOSST).

McCracken, M.C. (1973), An Overview of CANDIDE Model 1.0, CANDIDE Project Paper No. 1, (Ottawa: Information Canada).

Newton, Keith (1977), "Some Simple Analytics of the Phillips Curve: A Geometric Derivation", The American Economist, Vol. XXI, no. 2, pp. 59-61.

Reid, Frank, and Noah M. Meltz (1979), "Causes of Shifts in the Unemployment-Vacancy Relationship: An Empirical Analysis for Canada", The Review of Economics and Statistics 61, August 1979, pp. 470-475.

Tinbergen, Jan, and H.C. Bos (1965), Econometric Models of Education: Some Applications, (Paris: OECD).

U.S. Department of Labour, Bureau of Labour Statistics (1968), Occupational Employment Patterns for 1960 and 1975, Bulletin 1599.

Warren, Ronald S., Jr. (1980), "Unemployment and Unfilled Vacancies in U.S. Manufacturing: A Search-Turnover View", The Review of Economics and Statistics 62, May 1980, pp. 292-295.